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DEPARTMENT OF COMMERCE

BUREAU OF FOREIGN AND DOMESTIC COMMERCE

PHILIP B. KENNEDY, Director

SPECIAL AGENTS SERIES—No. 184

ELECTRICAL GOODS IN ARGENTINA
URUGUAY, AND BRAZIL

By

PHILIP S. SMITH

Trade Commissioner



PRICE, 20 CENTS

Sold by the Superintendent of Documents, Government Printing Office,
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LETTER OF SUBMITTAL.

DEPARTMENT OF COMMERCE,
BUREAU OF FOREIGN AND DOMESTIC COMMERCE,
Washington, August 1, 1919.

SIR: There is submitted herewith a report by Trade Commissioner Philip S. Smith on the markets for electrical goods in Argentina, Uruguay, and Brazil. During the war American goods have thoroughly established themselves in these three countries, especially in Brazil. In many lines they should continue to maintain a leading place on the market, but in order that they may do so American manufacturers will have to keep in close touch with the trade, particularly by working through active agents in the principal trade centers. The use of electricity is very widespread throughout the three countries, but the high cost of imported fuel and the lack of water power tend to limit its use in Argentina and Uruguay. In Brazil, on the other hand, there is a most promising future for electricity and electrical materials because of the immense amount of water power available. As this power is found for the most part in the coastal section of the country, it will be available for industrial enterprises and for general lighting, heating, and power purposes in the numerous towns and cities of this section, which includes the greater part of the population of the country. The present users of electrical materials are well acquainted with American goods, which are almost universally in good favor.

Respectfully,

PHILIP B. KENNEDY,
Director.

TO HON. WILLIAM C. REDFIELD,
Secretary of Commerce.

ELECTRICAL GOODS IN ARGENTINA, URUGUAY, AND BRAZIL.

ARGENTINA.

FEATURES OF ARGENTINE MARKET.

The Argentine Republic is the second largest in South America, having an area of 1,125,000 square miles. For the most part it is relatively flat, resembling to a certain extent the Middle Western States of the United States. The northern section, however, is covered with subtropical forests and a narrow strip along the western border is very mountainous, the boundary between Argentina and Chile being the line which touches the highest peaks of the Andean Cordillera. The great wealth of the country has been produced by agriculture and cattle raising, as the soil is extremely fertile in almost the entire extent of the country and can be worked by modern methods on a large scale.

The population is 7,885,000, which means a density of approximately 7 inhabitants per square mile, as compared with 35 per square mile in the United States, and 190 to 300 in the central countries of Europe. In normal years immigration steadily increased, and reached 302,000 in 1915. Two years later it had fallen to 15,000, and to-day it has stopped completely. The greater number of immigrants have always come from Spain, although Italy occupies a fairly close second place. Probably 90 per cent are farmers, or small merchants, and therefore do not contribute to any appreciable extent to the industrial growth of the nation. From the nature of the country, however, it must depend upon its soil, rather than upon manufacturing, and consequently this class of immigration is more desirable for the present. As time goes on it will be necessary to attract more mechanics and skilled laborers if the desired program of factory development is to meet with any degree of success. It is estimated that 20 to 25 per cent of the entire population lives in Buenos Aires and suburbs, and that practically 50 per cent lives in the country, or in small towns of a few thousand each. To this particular distribution of population is due the fact that in Argentina there are a large number of electric generating plants with less than 150 kilowatts capacity, as well as the largest single central station in South America.

CLIMATE.

In the west and northwest, where Argentina joins the Chilean Andes and the highlands of Bolivia, and in the extreme south of the Territory of Patagonia, the climate is very variable, there being frequent rains and fluctuating temperatures, which are, in general, much lower than any experienced in the central section. The latter is the great agricultural belt, and while subject to wide changes in temperature between the summer and winter months, does not have the rapid variations of the mountainous regions.

There is still a third division known as the Chaco, which includes the Territories in the northeast. Part of this division is within the Tropics and the general climatic conditions of the whole of it are those of the Torrid Zone. It is inhabited principally by Indians and is practically inaccessible except by water, small craft being able to ply upon the numerous streams draining that region, none of which are suitable for hydroelectric development, as the gradient is not sufficient to furnish a proper fall within a reasonable distance.

Of these three districts the central is the only one that is commercially important, as it is here that most of the people live. During the winter the thermometer stands usually around 40° to 50° F. and upon rare occasions drops to 32° or slightly lower. Snow has fallen in Buenos Aires a few times. This low temperature holds for some three months and makes life quite uncomfortable, especially to North Americans, except in those few buildings which have been equipped with central heating plants. Local heating by electricity would be ideal for this section and would add a great deal to the comfort of living. Once this fact is realized, a large field will be opened for the introduction of small devices for intermittent use. The chief obstacle in the way of making such material better known is the fact that the people have never been accustomed to artificial heat of any sort and are inclined toward the belief that it is detrimental to the health.

PRINCIPAL CITIES.

Argentina, on account of the concentration of a large part of its population in the central section, is largely dominated commercially by Buenos Aires, the Federal capital. The port there has been extensively developed and is being enlarged at the present time to take care of a greatly increased traffic, so that it will be in a position to handle all demands that are likely to be made upon it. The only other ports of much interest to shippers to Argentina are Rosario and Bahia Blanca. Both are deep-water ports and are well provided with freight-handling facilities, although they are more important as exporting than as importing centers. They are largely exploited by private companies which hold concessions from the Government and which are leaders in a movement to secure a greater share of the incoming freight from overseas. These companies are the Central Argentine Railway and the Buenos Aires & Pacific Railway, which would profit by carrying into the interior all freight entering at these ports and which bring to the terminal elevators all the grain which is exported through them, such exportation now being the principal business of Rosario and Bahia Blanca. It is highly desirable that our exporters should become better acquainted with these cities and with others in the interior, inasmuch as the life is in many respects quite different from that in Buenos Aires, and only by appreciating this can one form an accurate opinion regarding trade conditions over the country as a whole. As direct importing centers, however, they are of relatively little importance, as the greater part of the material purchased by merchants in these cities is actually bought through Buenos Aires, or through houses whose main offices are located there, with branches in the smaller cities.

Nearly all importers have travelers who cover the interior, or at least have agents or representatives in the important points who send their orders to Buenos Aires and draw their supplies from stocks maintained there. All banking houses are located in the capital, and even in cases where they have branches, no important foreign-trade transactions are handled, except through the main offices, where connections are established with European and American banks; so that it is only when goods are destined solely for the country contiguous to Bahia Blanca or Rosario or to those cities themselves are they chosen as ports of entry for foreign merchandise, and only under similar circumstances are the interior cities considered proper destinations for direct exporting.

Following is a list of larger cities, with the most recent estimate of the population of each:

Avellaneda -----	146,000	Mendoza -----	62,000
Bahia Blanca -----	75,000	Posadas -----	17,000
Buenos Aires -----	1,600,000	Paraná -----	37,000
Catamarca -----	14,000	Mar del Plata -----	28,000
Chivilcoy -----	24,000	Resistencia -----	24,000
Córdoba -----	135,000	Rosario -----	235,000
Concordia -----	25,000	Salta -----	38,000
Corrientes -----	40,000	San Juan -----	18,000
Gualiguaychu -----	21,000	San Luis -----	25,000
Jujuy -----	15,000	San Nicolas -----	31,000
La Plata -----	95,000	Santa Fé -----	55,000
La Rioja -----	17,000	Santiago del Estero -----	21,000
Lomas de Zamorra -----	23,000	Tucumán -----	70,000

FOREIGN TRADE.

In all branches of trade the imports from the United States have increased since the middle of 1914, owing largely to the disruption of the trade relations with Europe, which had been in operation for many years previous to that date. When it became apparent that material could not be obtained in quantities sufficient for the demands everyone turned to the United States for assistance, with the result that new agencies were established, and new brands never before seen on the market began to appear, while the old ones which had been exploited previously were able to increase their sales manyfold. Where these new trade connections resulted satisfactorily to the importer—that is, where the goods met the requirements of his trade, and the prices, terms of payment, manner of shipping, and other numerous details incidental to the business were arranged favorably—there is every likelihood that they will continue indefinitely in the future. It is obvious that no efforts should be spared which will assure this desirable condition. The following table shows the imports of electrical goods, listed by articles, for the years 1910 to 1917, both inclusive:

Articles.	1910	1911	1912	1913	1914	1915	1916	1917
Accessories, miscellaneous.....		\$106,936	\$149,936	\$223,358	\$171,597	\$225,372	\$162,023	\$108,811
Accessories for underground cable	\$73,888	510,187	516,789	162,984	79,061	19,344	12,724	19,030
Annunciators.....		11,839	7,865	7,196	4,390	1,765	689	710
Apparatus, telegraph		4,719	7,350	1,833	3,201	243	52	.....
Apparatus, telephone	89,324	78,029	87,749	92,250	40,845	16,903	6,866	14,884
Batteries, elements for		52,320	402,440	104,259	161,105	13,686	10,877	12,448

Articles.	1910	1911	1912	1913	1914	1915	1916	1917
Batteries, dry.....	\$21,775	\$37,233	\$49,495	\$45,640	\$45,615	\$38,798	\$48,511	\$60,054
Batteries, storage	8,533	6,020	74,513	26,886	22,629	1,419	4,974	4,389
Batteries, porous ele- ments for.....	14,682	18,978	20,554	18,367	18,921	13,125	19,218	6,389
Batteries, jars.....	.....	6,088	12,133	6,408	3,727	1,387	1,870	1,794
Bells.....	17,876	29,308	22,517	20,959	7,437	4,937	10,267	14,639
Carbons for arc lamps ..	72,270	89,501	137,837	133,340	75,337	58,532	26,993	13,087
Cleats.....	.....	2,853	5,648	10,621	9,963	1,694	2,654	13,673
Commutators (type of snap switch).....	.....	20,334	14,897	3,973	1,171	8,830	447	772
Commutators.....	.....	11,885	14,727	13,954	6,744	4,707	782	507
Current taps.....	.....	9,014	21,863	14,572	7,601	650	1,263	9,259
Cut-outs.....	.....	24,862	27,228	40,657	24,147	4,774	8,693	13,795
Fans.....	33,127	51,570	75,023	89,681	48,190	21,040	15,386	8,385
Fiber, vulcanized.....	11,283	11,856	18,989	32,120	35,626	11,999	8,506	11,522
Fuse plugs.....	.....	10,793	8,180	15,001	8,023	1,127	1,243	5,060
Generators and motors ..	523,056	877,166	1,637,757	1,088,029	642,844	278,921	111,065	195,953
Instruments.....	.....	14,296	20,781	32,257	7,488	6,259	5,476	54,329
Insulating tape.....	27,199	19,702	30,089	43,500	26,215	33,572	20,389	15,805
Insulating tubes (con- duit).....	94,754	142,938	173,156	303,220	133,750	42,049	63,890	41,083
Insulators, glass.....	720	143	215	345	1,267	96	159	234
Insulators, porcelain...	78,065	111,398	126,086	120,214	70,353	37,089	22,293	25,477
Lamps, arc.....	112,589	131,441	125,840	225,559	62,231	11,163	1,023	282
Lamps, incandescent..	576,450	448,456	425,825	478,101	248,343	211,488	300,131	470,173
Material for telegraph..	35,197	25,992	72,788	41,653	54,128	13,299	8,660	12,648
Material for telephone..	27,227	21,461	24,455	56,068	15,214	4,153	1,967	3,513
Material, miscellaneous	544,326	438,038	751,942	532,210	999,574	507,474	690,149	465,695
Meters.....	192,216	409,330	483,141	687,887	265,958	305,573	295,195	339,259
Motors, small.....	43,448	43,039	123,095	88,595	17,015	22,373	28,395	12,815
Push buttons.....	5,183	8,057	10,120	7,870	5,522	734	1,119	255
Rosettes.....	.....	9,034	20,714	13,162	8,961	1,174	849	1,453
Snap switches.....	.....	77,531	115,646	107,848	63,336	22,378	18,405	24,617
Sockets.....	112,324	57,994	77,895	60,471	55,553	35,024	37,014	66,572
Switchboards.....	.....	.....	.....	32,647	48,964	11,876	3,483	11,989
Wire and cable.....	2,825,063	2,519,403	3,087,700	4,772,530	3,275,674	1,630,126	1,267,484	720,305
Total.....	5,540,575	6,449,744	8,982,978	9,756,234	6,777,721	3,625,155	3,221,184	2,781,765

Until the beginning of the war the largest part of the electrical-goods imports always came from Europe, the combined values from England and Germany alone amounting to 76 per cent of the total in 1911, 85 per cent in 1913, and 52 per cent in 1915. From the United States in the same years the imports were, respectively, 7 per cent, 6 per cent, and 20 per cent of the totals, the amount for 1915 having been 27 per cent greater than that for 1913, which was the largest previous year. That the imports from the United States showed such a percentage gain in 1915 is due principally to the fact that the total from all countries was only 37 per cent of the 1913 total. It was not until 1917 that the United States passed England in this trade, our exports to Argentina in that year being 50 per cent of the total.

The following table shows the imports of electrical goods from the principal countries of the world, 1910 to 1917:

Countries.	1910	1911	1912	1913	1914	1915	1916	1917
Austria-Hungary.....	\$26,890	\$21,551	\$12,654	\$26,606	\$13,973	\$819	.....	.....
Belgium.....	159,216	84,577	294,484	62,515	69,993	.....	\$727	.....
France.....	85,257	277,002	197,612	142,183	184,149	25,860	34,358	\$23,492
Germany.....	2,443,268	3,328,156	5,158,797	4,892,538	3,089,235	262,457	5,946	5,880
Italy.....	282,483	478,788	409,032	513,245	847,644	767,941	424,043	233,484
Netherlands.....	95,218	99,090	90,360	112,871	89,207	142,833	219,111	293,719
Sweden.....	21,640	26,542	23,924	24,593	15,335	11,733	5,301	9,695
Switzerland.....	19,261	18,341	14,731	9,959	5,638	31,051	39,602	79,617
United Kingdom.....	1,838,213	1,601,924	2,232,970	3,358,711	2,186,215	1,620,697	1,562,362	669,035
United States.....	553,791	475,991	529,078	577,126	257,344	735,478	885,888	1,375,499
All other.....	15,338	37,782	21,336	35,887	18,988	26,286	43,846	91,344
Total.....	5,540,575	6,449,744	8,982,978	9,756,234	6,777,721	3,625,155	3,221,184	2,781,765

IMPORTS BY COUNTRIES AND CLASSES.

The following table gives the value of imports of electrical goods, with the amount furnished by the principal supplying countries, for 1913, 1915, and 1916:

Articles and countries.	1913	1915	1916
Accessories for underground cables.....	\$162,984	\$19,385	\$12,724
United States.....	40,470	7,345	11,520
Germany.....	102,835	35	.....
Spain.....	.....	3,580	124
Switzerland.....	.....	3,230	.....
United Kingdom.....	17,285	4,195	238
Accessories, electrical, n. e. s.....	223,358	225,372	162,023
United States.....	61,420	44,300	62,870
Brazil.....	.....	25	1,470
Germany.....	66,120	24,925	.....
Italy.....	923	11,150	8,07
Spain.....	.....	440	2,110
Switzerland.....	.....	.....	2,670
United Kingdom.....	91,495	143,735	84,535
Annunciators.....	7,196	1,765	689
United States.....	788	1,120	668
France.....	89	181	.....
Germany.....	4,996	528	.....
Apparatus, Morse telegraph.....	1,833	243	52
United Kingdom.....	1,585	121	52
Apparatus, telephone.....	92,250	16,903	6,866
United States.....	8,750	1,013	2,615
Germany.....	28,630	885	.....
Sweden.....	11,830	4,080	586
United Kingdom.....	33,030	10,895	3,655
Batteries, elements for.....	104,259	13,686	10,877
United States.....	1,345	330	1,235
France.....	2,025	1,025	168
Germany.....	81,390	527	.....
Italy.....	807	1,930	150
Spain.....	43	2,120	2,900
United Kingdom.....	17,280	7,695	6,415
Batteries, dry.....	45,640	38,798	48,511
United States.....	12,870	22,495	33,275
Denmark.....	7,135	5,275	3,271
United Kingdom.....	18,680	10,190	10,445
Storage batteries.....	26,886	1,419	4,974
United States.....	96	242	633
United Kingdom.....	25,280	1,160	4,075
Batteries, porous elements for.....	18,367	13,125	19,218
United States.....	68	58	891
France.....	2,775	801	1,090
United Kingdom.....	12,710	12,200	17,210
Batteries, jars.....	6,408	1,387	1,870
France.....	1,085	199	.....
Germany.....	1,185	318	.....
United Kingdom.....	3,890	822	1,790
Bells, electric.....	20,959	4,937	10,267
United States.....	4,795	1,685	10,035
France.....	419	897	8
Germany.....	13,320	1,745	.....
United Kingdom.....	2,085	565	145
Carbons for electric light.....	133,340	58,532	26,993
United States.....	729	30,250	20,865
France.....	1,230	732	1,300
Germany.....	110,320	15,300	315
Italy.....	206	4,775	.....
Netherlands.....	.....	608	449
Paraguay.....	.....	1,445	.....
Spain.....	57	3,935	3,115
United Kingdom.....	20,735	1,325	318
Cleats.....	10,621	1,694	2,654
United States.....	90	3	1,845
Germany.....	9,405	1,315	219
United Kingdom.....	267	26	374

Articles and countries.	1913	1915	1916
Commutators (type of snap switch).....	\$3,973	\$8,830	\$447
United States.....	2	6,105	.....
United Kingdom.....	2,451	2,530	423
Commutators, other.....	13,954	4,707	782
United States.....	3,235	.....	193
Sweden.....	2,692	291	262
United Kingdom.....	5,580	4,300	326
Current taps.....	14,572	650	1,263
United States.....	4,790	455	1,070
United Kingdom.....	487	50	139
Cut-outs.....	40,657	4,774	8,693
United States.....	2,360	3,330	4,300
Germany.....	26,645	671	28
United Kingdom.....	11,560	756	4,360
Fans.....	89,681	21,040	15,386
United States.....	13,970	8,410	4,960
Germany.....	11,985	5,370	.....
Italy.....	58,135	2,084	10,320
United Kingdom.....	5,525	5,165	104
Fiber, vulcanized.....	32,120	11,999	8,506
United States.....	2,355	1,690	4,260
Germany.....	5,290	418	11
United Kingdom.....	22,855	9,865	3,835
Fuse plugs.....	15,001	1,127	1,243
United States.....	49	326	186
Germany.....	11,465	728	1,055
Generators and motors.....	1,088,029	278,921	111,065
United States.....	45,515	32,400	36,850
France.....	19,280	799	90
Germany.....	490,905	28,375	759
Italy.....	67,565	98,865	29,400
Spain.....	26	3,035	2,150
Sweden.....	5,970	2,725	2,050
Switzerland.....	3,425	10,675	2,570
United Kingdom.....	451,005	100,570	36,530
Instruments, ammeters, and voltmeters.....	32,257	6,259	5,476
United States.....	975	745	2,560
France.....	1,535	1,890	739
Germany.....	22,850	2,435	5
United Kingdom.....	4,303	1,140	1,740
Insulating tape.....	43,500	33,572	20,389
United States.....	12,475	26,730	15,765
Italy.....	3,755	2,920	2,385
United Kingdom.....	8,000	2,395	705
Insulating tubes (conduit).....	303,220	42,049	63,890
United States.....	23,330	1,200	16,505
France.....	3,235	744	2,675
Germany.....	117,400	16,125	189
Italy.....	1,410	.....	1,205
Netherlands.....	5	10,365	8,020
Norway.....	.....	.....	868
Switzerland.....	698	1,170	8,310
United Kingdom.....	151,820	11,770	25,420
Insulators, glass.....	345	96	159
United States.....	63	96	153
Insulators, porcelain and earthenware.....	120,214	37,089	22,293
United States.....	1,765	4,465	7,435
Chile.....	.....	.....	2,910
Germany.....	66,715	4,105	61
Italy.....	.....	194	1,240
Spain.....	.....	5	1,485
Sweden.....	.....	302	1,195
United Kingdom.....	45,170	27,795	7,660
Lamps, arc.....	225,559	11,163	1,023
United States.....	702	1,015	386
Germany.....	210,675	3,075	.....
Italy.....	173	3,350	.....
United Kingdom.....	13,845	3,705	613

Articles and countries.	1913	1915	1916
Lamps, incandescent.....	\$478,101	\$211,488	\$300,131
United States.....	41,075	36,050	87,990
France.....	3,640	1,020	2,005
Germany.....	232,490	23,475	168
Italy.....	663	13,245	3,350
Netherlands.....	105,125	110,700	177,420
Switzerland.....	225	2,220	7,370
United Kingdom.....	64,880	23,485	20,790
Materials, telegraph.....	41,653	13,299	8,660
United States.....	9,905	643	.....
Sweden.....	4,700	4,825	.....
United Kingdom.....	25,805	7,505	8,210
Materials, telephone.....	56,068	4,153	1,967
United States.....	7,035	1,230	1,145
Sweden.....	1,385	565	131
United Kingdom.....	23,960	2,095	639
Materials, miscellaneous.....	532,219	507,474	690,149
United States.....	38,890	93,365	84,385
France.....	9,175	4,660	3,040
Germany.....	225,360	9,950	254
Italy.....	3,110	45,340	25,805
Netherlands.....	600	337	2,930
Spain.....	19	942	5,355
Switzerland.....	4,365	1,080	12,700
United Kingdom.....	243,440	351,095	555,255
Meters.....	687,887	305,573	295,195
United States.....	10,175	127,090	184,150
Brazil.....	.....	.....	1,015
Chile.....	.....	1,630	278
France.....	1,331	393	17,470
Germany.....	630,725	70,680	590
Italy.....	92	59,160	35
Switzerland.....	.....	11,900	5,790
United Kingdom.....	43,505	34,400	85,805
Motors, small.....	88,595	22,373	28,395
United States.....	64,090	22,030	28,240
Germany.....	15,475	23	.....
United Kingdom.....	7,865	308	123
Push buttons.....	7,870	734	1,119
United States.....	421	98	685
Germany.....	6,300	496	366
Rosettes.....	13,162	1,174	849
United States.....	1,396	756	756
Germany.....	11,700	169	93
Snap switches.....	107,848	22,378	18,405
United States.....	41,720	14,645	14,030
Germany.....	60,555	2,705	1,990
Italy.....	1,415	3,660	387
United Kingdom.....	2,475	1,130	1,410
Sockets.....	60,471	35,024	37,014
United States.....	10,065	8,850	31,985
Chile.....	.....	.....	1,540
Germany.....	46,135	18,085	145
Italy.....	.....	6,425	1,905
United Kingdom.....	2,690	380	1,355
Switchboards.....	32,647	11,876	3,483
United States.....	2,055	2,644	1,688
Germany.....	11,800	1,563	.....
United Kingdom.....	18,580	7,000	1,615
Wire and cable.....	4,772,530	1,630,126	1,267,484
United States.....	116,560	232,810	209,235
Belgium.....	31,890	.....	.....
France.....	71,285	10,490	3,115
Germany.....	2,227,600	22,390	.....
Italy.....	368,900	513,790	338,340
Netherlands.....	1,615	18,450	29,810
Spain.....	.....	.....	10,820
Sweden.....	51	1,395	218
United Kingdom.....	1,953,060	830,145	675,680
Grand total.....	9,756,234	3,625,155	3,221,184

AGRICULTURE AND RELATED INDUSTRIES.

The great staple products are wheat, cattle, and wool. The country is eminently suited to agriculture and cattle raising, as it is mostly a vast level plain unbroken by either mountains or rivers. The colder southern section is devoted largely to sheep, while the south central and central sections are the grain and beef producing regions. The northern section is rich in woods of various kinds, but as yet it is very little exploited.

Electricity plays an important part in the operations of the meat-packing establishments and terminal grain elevators, all machines being motor driven. There has been a movement on foot for several years to establish a number of country elevators and these will increase the demand for similar electrical equipment. This business will undoubtedly be obtained by some company working in conjunction with the contractor who builds the elevators under Government concession. Little definite information on this situation is obtainable, but it is probable that the work will be awarded to American firms which have been following the project from its inception.

Practically all of the meat freezing and packing industry is in the hands of American concerns, and consequently the machinery is bought in the United States according to specifications prepared for their main plants. The two principal companies are Swift and Armour, both of which have interests also in Uruguay and Brazil.

Wine is produced on a large scale in Mendoza and electric power is used in its preparation and handling, in making and repairing the barrels and other containers, and in lighting the buildings and deposits. Much of this power is generated by isolated plants consisting of Diesel engine sets located at the various establishments. The necessary material for renewals and additions to the equipment is bought direct from Buenos Aires houses or through their local agents.

PRODUCTION OF MINERALS.

Petroleum is now being extracted in quantities from the fields at Comodoro Rivadavia and electricity is used there, but not to the same extent as in some of the oil districts of the United States.

Coal is also being produced, but only on a small scale and from surface mines. The present scarcity may give an impulse to the industry which will be lasting, as the lack of water power or abundant fuels is a great drawback to the country's industrial development. All coal was formerly imported from England or the United States, at a fairly high cost, although not high enough to encourage the working of national deposits. Taking advantage of the abnormal conditions, it is hoped that sufficient progress can be made to enable the industry to prosper and continue in competition with imported coal later on. This can be done only with the assistance of machinery, which presumably will be moved electrically.

Since the same range of mountains which has been so productive in Bolivia and Chile also forms the western boundary of Argentina, it is reasonable to expect that the same minerals are present in Argentine territory as in the other countries and that some day they will be exploited. When this takes place there will be a demand for

electrical apparatus, but at present there is practically no mining which has reached the stage of development where machinery is required for anything other than the most simple operations.

INTEREST IN MANUFACTURING.

There has been a strong prejudice against national products generally and in favor of imported goods; so much so that many articles carry foreign labels in order to deceive the buyer. All the factories, however, and the Government itself, are back of a movement to accredit the home product. Placards are posted in conspicuous places or displayed in show windows, the general theme of all being that to buy anything made by an Argentine workman is much to be preferred to sending the money out of the country to support foreign labor. There are frequent exhibitions of domestic industries and their products, one such being permanently and attractively housed on one of the busiest street corners in Buenos Aires. All of this is bearing fruit in an unmistakable turning of public opinion toward national goods.

The following table is based upon the Government census for 1913, and shows the principal industries, number of employees, value of products, and amount of power used in each:

Character of industry.	Estab-lish-ments.	Total pro-duction.	Horse-power.	Em-ploy-ees.
Alcohol.....	187	\$3,364,134	1,456	1,133
Artistic ironwork.....	35	1,434,744	242	827
Bakeries.....	3,242	34,709,770	6,514	27,105
Breweries.....	29	15,163,839	8,680	2,599
Brick kilns, etc.....	953	9,383,312	2,090	10,485
Carpentry, painting, and horseshoeing.....	4,681	15,150,120	3,970	18,454
Chocolate and candy.....	299	8,761,916	2,337	3,854
Clothing, etc.....	448	8,772,495	657	4,986
Cleaners and dyers.....	124	1,455,873	1,031	1,641
Coffee roasters, etc.....	54	2,300,725	191	517
Confectionery.....	185	2,024,445	113	1,856
Cigars and tobacco.....	179	2,162,705	95	2,826
Cigarette factories.....	55	22,471,474	1,191	4,295
Cotton and woolen mills.....	81	10,722,594	6,887	8,384
Crackers and cakes.....	207	4,451,572	588	2,062
Construction companies.....	197		565	7,664
Dairies, cheese factories, etc.....	8,161	22,439,534	3,317	28,589
Dressmakers.....	574	3,300,508	15	3,754
Extracts of tannin and preparation of firewood.....	493	17,778,903	12,874	19,616
Flour mills.....	401	63,282,112	26,531	5,909
Foundries and metal works.....	1,177	24,987,634	14,161	16,109
Furniture, trunks, and tapestry.....	1,058	9,771,501	2,206	8,101
Fishing.....	4	2,416,961	17	278
Gas fitters, etc.....	353	1,803,173	25	2,321
Glass factories.....	16	1,807,950	269	2,136
Grain elevators.....	19		6,137	1,666
Hats.....	92	3,662,194	1,298	2,362
Ice and aerated waters.....	742	7,290,659	7,965	3,864
Jewelry, watches, etc.....	769	4,098,250	43	2,321
Jute and cotton sacks.....	24	16,200,466	1,248	1,808
Leather shoes.....	231	20,884,830	2,388	12,869
Liquors.....	326	13,775,247	1,518	3,035
Lithographers and printers.....	938	15,409,435	2,985	11,491
Leather goods.....	986	9,746,658	326	5,497
Macaroni and pastes.....	332	8,261,764	4,216	3,880
Match factories.....	16	5,951,700	610	3,094
Meat-packing houses.....	13	114,004,927	24,287	14,687
Ore smelters.....	29	744,987	797	793
Paving companies.....	14	5,397,755	140	1,932
Paper and cardboard mills.....	11	4,922,945	10,860	1,901
Petroleum refineries.....	1	1,062,500	265	220
Preparing and refining oil.....	22	2,750,706	969	468
Preparation of salted hides.....	8	209,950	55	45
Preparation of yerba mate.....	31	9,328,448	1,128	1,051
Preparation of wine.....	4,317	36,248,745	14,651	16,362

Character of industry.	Estab- lish- ments.	Total pro- duction.	Horse- power.	Employ- ees.
Rope and cloth shoes.....	241	\$7,133,657	1,097	4,764
Sawmills.....	305	19,220,005	13,514	7,378
Shoemakers.....	2,243	4,828,491	69	7,052
Soap factories.....	294	9,123,774	964	2,092
Sugar refineries.....	44	59,754,304	57,511	14,685
Tailors.....	3,083	21,554,202	34	21,380
Tanneries.....	189	13,655,719	5,416	3,474
Tinsmiths, etc.....	974	2,878,153	133	3,071
Wagons and carriages.....	1,270	8,519,085	3,882	8,291
Woodworking.....	736	12,503,539	6,906	5,903
Wool washing.....	10	1,038,545	885	255
Miscellaneous.....	6,971	62,487,327	18,479	48,093
Total.....	48,474	791,260,627	286,798	400,285

RAW MATERIAL—SCARCITY OF FUEL.

The raw material for much of the output has to be imported, so that the only advantages enjoyed by home manufactures over imported goods lie in a protective tariff, the higher ocean freight rates for finished goods than for raw materials, and lower labor costs. Minerals are found to some extent, but mining is conducted on too small a scale to be of any real assistance to the manufacturer. Wool and hides are abundant and cotton and timber production can be greatly increased if proper incentives are offered. The one thing that is lacking is cheap fuel. No large water falls are available, and wood, imported and native coal, and petroleum are the most common substitutes. Practically the only solution to this problem is for factories to group themselves about a central station of large capacity such as the two in Buenos Aires, and take electric power from them. Having an installation of many thousands of kilowatts they can offer rates that are less than the cost of current produced on a small scale in isolated plants. As a matter of fact, the rates are as low as those quoted in many cities in the United States, which is remarkable, considering the great cost of importing everything which enters into the production of electricity. Crude petroleum, for instance, costs over \$40 per metric ton and Cardiff coal nearly as much.

One effect of this condition is that a large number of small producers of electrical energy or users of other forms of power have changed over to central-station service, thus creating a greater demand for motors and all kinds of wiring devices and accessories. Undoubtedly once having become accustomed to this reliable form of power, they will not want to return to the old ways, and the business which is now being built up will be permanent. It is not to be expected that this will be large in comparison with that of a similar industrial center in the United States, as it could never attain such volume, but as compared with business previous to 1914 it already represents a marked advance.

MAKING OF ELECTRICAL DEVICES.

Offsetting, somewhat, this greater demand for motors and wiring devices, is the increasing local production of certain lines of electrical material which were formerly imported in fairly large quantities, so that the net result will probably be an importation of goods

to the same value as in earlier years, but not of the same kind. A good example of this change is to be found in the trade in chandeliers and fixtures. These articles can not be brought into the country in competition with local products unless they are of unusual or very original design, several firms being in position to make them in types most acceptable to the country. Of somewhat less importance, but still showing the general trend, is the manufacture of insulated wire, direct and alternating current meters, and all kinds of heating and cooking devices. On a still smaller scale there are shops turning out dry batteries, carbon brushes, and insulated conduit (Bergmann type). Several years ago the manufacture of incandescent lamps was begun, but the business was unsuccessful. The company was permitted to liquidate and retire from business in 1918, it being understood that others were to attempt to carry on the manufacture with the same machinery, which is of European make. Although this report was not confirmed, it indicates the present interest in manufacturing.

The locally made devices are, in general, quite as satisfactory as the imported, although not nearly so well finished. The crude appearance is more than made up, however, by the difference in price, which is sufficient to induce many to purchase. It would not be surprising, therefore, to find many Argentine-made articles, such as wire and cable, irons and small heating devices, dominating this market in the not very distant future. A tariff that gives more protection than the one at present in force is now being proposed, and if it goes through it will have a very adverse effect upon the imports in these lines.

PROTECTIVE TARIFF ADVOCATED.

In this connection it is interesting to note the opinion of Mr. Carlos A. Tornquist, a leading Argentine financier and economist:

The constant decline in the volume of our imports during the years of war has operated favorably upon the national economy. The necessity for supplying this shortage in manufactured products and the very satisfactory prices offering for them have given rise to a considerable and varied industrial activity in the country, which in a short time has made possible the export of many industrial products in relatively important quantities to certain of the European belligerent countries. This productive evolution of the country will be a factor of vital importance in the national prosperity once the war is over, when it is logical to expect that some of the favorable factors above indicated will disappear.

Every system of national political economy ought necessarily to tend toward producing a favorable balance for the country in its annual "balance of payments," solidifying thus, as time goes on, the economic independence of the nation so far as that is possible. Our unavoidable duty, therefore, is to support our new manufacturing industries and to stimulate their expansion by intelligent protective legislation in order that their products may replace, in our own consuming market, the merchandise we have hitherto imported from abroad, and perhaps even compete advantageously with the foreign article in the foreign markets. Many industries encounter favorable conditions in the country, seeing that we produce large quantities of the raw material they require. Moreover, we ought to guard against the unfavorable developments to which our foreign trade may be exposed after the war. Shall we have a market, secure and firm for our agricultural and pastoral products, at the moment when we shall be compelled by necessity to renew almost our entire stock of merchandise, thus putting the "balance of payments" to a severe test?

Some of the larger factories obtained trained men from abroad to take charge while the operatives were learning, and they have made a point of developing competent assistants. From time to time these have drifted away to smaller factories and shops, forming in this way a nucleus around which is growing up a well defined skilled-labor element. The education of mechanics in various lines has progressed so that, so far as labor is concerned, the prospects for industrial expansion are becoming brighter each year.

ARCHITECTS AND ENGINEERS.

It is customary to employ architects for all building operations of any kind whatever, and some opportunity is offered for the contractor or manufacturer to influence the owner with regard to the electrical equipment to be installed. Little effort along this line is made as a general rule, but in such instances as have been noted the success obtained justifies the opinion that if the practice were followed more extensively, very valuable propaganda in favor of better materials could be carried on. In the absence of any real rules or regulations relating to electrical installation, this offers one of the best ways, and about the only practical way, of accomplishing more or less the purpose for which such rules are usually designed.

There are no consulting electrical engineers. European manufacturing concerns always made a point of having their own engineers, who were always at the disposal of prospective customers. This was done principally to discourage independent engineers from control of the market. They charged nothing for the advice of the engineers or even for laying out entire plants, for while this added to the overhead expenses of the offices, it was more than offset by the growing number of installations which they were able to obtain with this cooperation. Naturally, the engineers recommended the products of their own factories, and it was rare indeed that a person who availed himself of this service purchased the material elsewhere. It was not an uncommon practice for these companies to furnish foremen for the erection of new plants or machinery, and operators were frequently engaged from among their own staff, or from that of the central station. In this way the country was becoming filled with plants containing European machinery, run by men familiar only with those types, and ready at all times to recommend their use.

A strongly financed American company or combination adopting liberal policies in this and other respects would be able to go far toward meeting this competition and gaining for itself a considerable portion of the new business which will make Argentina one of the best foreign markets for electrical goods.

TECHNICAL SCHOOLS.

More and more of the young men of Latin America are turning to engineering in its various forms and making good in it as a profession. In Argentina the Industrial School of the Nation (*Escuela Industrial de la Nación*), under the jurisdiction of the Minister of Justice and Public Instruction, has been accumulating very com-

plete laboratory and electric-power equipment.^a This school has about 900 students, and in electricity, which is one of its strongest branches, it gives a special two-year course, after the four years of general study. Relatively slight attention is given to theory, as the object is to prepare the students for high-class semitechnical work in industrial establishments. In addition to this, which is the largest school of the sort, there are now schools which offer courses in the practical side only, while nearly all the universities have been enlarged by the addition of complete engineering departments, with a laboratory and workrooms. It is in these institutions that the students gain their first ideas concerning the machinery which they handle, and the methods which they study make a lasting impression on them. Perhaps it was this fact that influenced European manufacturers to sell machinery, charts, models, etc., to the schools at a very reduced figure, or even to give them free of cost. German devices are greatly in the majority, and the Industrial School of the Nation acknowledged receipt from German companies during 1916 of some 200 articles, including meters, flexible cord, insulators, and transformers. In the same year, three American companies donated a few articles, which make a very poor showing in comparison with those above mentioned.

Opportunity for legitimate advertising is offered here, and it should neither be overlooked nor underestimated. Any company, with permanent representation in Buenos Aires, could inform itself regarding the method to be followed in offering goods of its manufacture to the several engineering schools, resting assured that they are all only too glad to receive any sort of device or material for enriching their equipment, especially if it be something the students can handle and test, or something which marks a new step in the program of instruction or design.

TECHNICAL SOCIETIES.

There are three well-established organizations devoted to engineering, of which two are purely electrical. These are the Instituto Sudamericano de Electrotecnicos y Mecanicos, and the Asociación Argentina de Electrotecnicos.

The members of the former are principally wiremen and station operators and the institute, therefore, is in an excellent position to disseminate practical information where it will do the most good. It issues a semimonthly magazine containing translations from foreign publications, as well as original information and contributions furnished by its members.

The Asociación Argentina de Electrotecnicos is composed almost entirely of graduate engineers who are in private practice or in the employ of large companies or of the Argentine Government. They hold regular meetings for the presentation of papers on subjects of current interest and arrange frequent visits of inspection to local engineering works.

^a A detailed account of the equipment in this school will be found in a publication of the Bureau of Foreign and Domestic Commerce entitled "Markets for Machinery and Machine Tools in Argentina," Special Agents Series No. 116, by J. A. Massel, which can be obtained for 20 cents from the district offices of the Bureau or from the Superintendent of Documents, Government Printing Office, Washington.

The library is well equipped with books on various phases of the development and application of electricity, a majority of them being of European origin, as relatively few American books have been translated into Spanish. All the current engineering magazines published in the United States, however, are received regularly. It would be a considerable incentive to a closer study of the articles contained in them if all figures and dimensions were given in the units of the metric as well as the English system. In the latter case it is always necessary for the reader to make the conversion, and this is often difficult and always annoying. It causes a good deal of surprise to foreign engineers that we still cling to such units when dealing with scientific subjects, when the metric system has been made obligatory in so many countries much less developed technically than the United States.

The influence felt in the association is largely European, owing to the presence of European engineers and the active interest in it taken by the central station and large manufacturing companies. Recently a few engineers with training in the United States have endeavored to bring American standards into greater prominence, and anything that will encourage and assist them will be sure to bring good results in the future.

TECHNICAL MAGAZINES.

In addition to the official organs of the foregoing societies, there are several magazines devoted to engineering and technical matters, and these frequently have sections especially devoted to electrical subjects. Foreign magazines are eagerly consulted in libraries, and those who can read languages other than Spanish are usually subscribers to one or more for their own account. The possible circulation would hardly justify an American magazine in going to the expense of getting out a Spanish edition if only electrical subjects were reviewed, but this would probably be practicable if other branches of engineering were also covered.

The following are the most important technical magazines published in Argentina:

La Electricidad y La Maquinaria. Illustrated technical journal. Official organ of the South American Institute of Electricians and Mechanics (Instituto Sudamericano de Electrotécnicos y Mecánicos).

La Industria de Cueros y Calzados. Illustrated journal devoted to the shoe and leather industry.

La Ingeniería. Illustrated technical journal. The official bimonthly publication of the National Engineers' Club (Centro Nacional de Ingenieros).

Las Nuevas Tendencias Económicas. Illustrated monthly journal of international economy.

El Constructor. Semitechnical magazine devoted to construction, construction material, and kindred topics.

El Chauffeur. Magazine published in the interests of automobilism.

El Inventor. Magazine purporting to further interest in invention and to stimulate national inventors.

Revista Azucarera. Monthly magazine and review of the sugar industry, both at home and abroad. Official organ of the Sugar Institute (Centro Azucarero).

Revista Técnica. Technical review of industrial progress at home and abroad.

Boletín de la Asociación Argentina de Electrotécnicos. Monthly publication and official bulletin of the Argentine Electrical Engineers' Association.

TRANSPORTATION FACILITIES.

The excellent transportation system of which Buenos Aires is the center makes of it the leading city in Argentina from the importer's and exporter's standpoint. Railroads radiate to all parts of the interior, and the numerous trunk lines are interconnected at frequent intervals with branches which tap the large agricultural and cattle-raising regions of the several Provinces in the central part of the Republic. There is thus provided rapid means of reaching all of the cities and towns of importance in the interior. The principal offices of nearly all business houses are located in Buenos Aires, where they are in a position to look after the shipments and payments of all goods consigned to them. To a small extent the imported goods are transported to Paraguay, Uruguay, and occasionally also to Bolivia and southern Brazil. Various river and ocean lines maintain communications with ports on the River Plate and in southern Argentina.

All local transportation such as warehouse trucking and the moving of goods from railway stations to the remote towns of the interior is carried on by horse-drawn vehicles. The city streets in almost all cases are well paved and adaptable to the use of automobiles, but the use of these vehicles is confined at present almost entirely to Buenos Aires. Electric trucks are unknown, and no effort is being made to push their sale. Previous efforts in this direction have proved quite unsuccessful, owing to various causes, among which may be mentioned the high cost of the vehicles themselves and the expense of maintenance and operation in comparison with horses, which are raised locally in great numbers and which are relatively very cheap.

A glance at the list of the numerous trans-Atlantic steamship lines touching at Buenos Aires in normal times shows that all the important European nations have been able to make frequent direct shipments, whereas we have had to rely principally upon whatever steamers might be competing for our business. Within the last year or so a Japanese steamship company has established a direct line between Japan and Buenos Aires, indicating an intention to push trade between Japan and Argentina.

IMPORTANCE OF SPANISH CATALOGUES.

All correspondence should be in Spanish, since that is the language of the country. An exception can be made, of course, in case it is known that the customer understands and accepts English; but it often happens that the manager of a native house knows English and none of his employees do, so that even in this case Spanish is almost necessary. Catalogues and circulars intended for general distribution must without exception be in Spanish, if they are to attract any attention or keep out of the waste basket. Very few persons will take time to decipher a catalogue if they have reason to believe that it will not interest them, as is too frequently the case, and consequently many never even attempt to translate English catalogues.

The metric system is the standard and the only one generally understood, while in many countries its use is actually obligatory. It should always be used on all packages and in documents or literature of any sort.

PATENTS AND TRADE-MARKS.

Owing to the present system of registering trade-marks and patents it is highly desirable for any firms contemplating the introduction of a device with a well known patent or trade-mark to register it first and thus prevent unscrupulous persons from pirating it or reserving the right to its use in their own name. As in various other countries, cases have been known where prominent articles have been kept entirely out of the market, or where the real owner has had to pay a high price to secure the right to use his own mark which had been registered by another. Competent trade-mark attorneys in this country or in Argentina are available for taking care of this matter at a minimum of expense. A complete treatise on this subject was published in a bulletin of the Bureau of Foreign and Domestic Commerce, entitled "Registration of Trade Marks in Latin America," Tariff Series No. 31, which can be obtained from the Superintendent of Documents, Government Printing Office, Washington, or from the district offices of the Bureau for 5 cents.

A convention between Argentina and the United States provides protection in either country for devices patented in the other, and exporters should take advantage of it by applying for recognition of priority of manufacture, thereby enjoying for a term of years not to exceed the life of the original patent, the sole right to import or manufacture the article in Argentina.

BANKING AND CREDIT.

In addition to banks of Argentine nationality, there are many foreign banks, including one or more from all the leading export nations, including England, France, Germany, Italy, Japan, Spain, and the United States. There is, therefore, no lack of facilities for taking care of such financial operations as may be required. The direct benefits derived from assistance given to our business houses by the two American banks have been very great, principally because we no longer have to depend upon more or less friendly foreign organizations for handling our commercial paper or for advice regarding the credit standing of local merchants. The service offered by these banks is too well known to need particular comment here, but it might be pointed out that in addition to furnishing general market reports on the important commodities and putting local importers in touch with American manufacturers they give special help to their depositors according to the individual needs of each, thus keeping them closely in touch with the market.

The fear of losing money through bad debts has undoubtedly kept many exporters from extending the terms of payments which are essential to a successful foreign trade. Most of this fear is unfounded, as is well known by all who have taken time to get an understanding of conditions here. Business honor is as high and a good name is as well guarded among respectable firms as anywhere in the world. Any house which upon investigation is found to

be entitled to credit is sure to take good care to meet all its obligations at the proper time.

All the European banks make a special point of extending credit to reliable concerns and it is said by various business houses that their loss from bad debts has been less than among their corresponding domestic clients. It should be emphasized that in the future it will be impossible to strengthen our relations with the large importers of electrical goods unless we are willing to offer a reasonable length of time within which to make payments, and that in so doing there is little risk for the house which takes advantage of the numerous facilities for obtaining credit information.

TERM OF PAYMENT.

The time allowed for payments before the war varied, but the standard terms usually offered and accepted were 90 days from receipt of draft with an option of a 2 per cent discount for cash upon delivery of documents. These terms are satisfactory to-day in the majority of cases, although the cash discount should be offered with some discretion, for while most dealers recognize its value and take advantage of it, there are others who feel that their credit is being reflected upon and that they ought to receive the lower price as well as the 90 days in which to pay. Where longer credit was necessary it was common to give 120 days, while not infrequently goods were even placed on consignment. It may be said that the extraordinarily long credits were not wanted and as a rule were resorted to more to keep out competitors or get what seemed to be a particularly good piece of business than as a regular practice. One of the principal houses exporting wiring devices and small supplies to Argentina was the Lüdenscheider Metall Werke, A. G., Lüdenscheid, Germany. On its billhead this company stated that all bills are "payable at Lüdenscheid in 90 days net or in 30 days with a 2 per cent discount." These were the domestic terms and they were modified for export business so as to permit payment of costs with the 2 per cent discount upon receipt of documents or 90 days net after arrival of draft. The former meant practically two months and the latter five months from date of invoice until receipt of money by the factory, but by the use of the special banking facilities which were available to the firm it obtained 80 per cent of the value of the invoice immediately upon making shipments so that it had only 20 per cent tied up during the credit period, the rest being used to carry on the business. By extending this principle to the limit its capital could be made to do the work of three or four times the amount tied up in long-time credits. If it has been a lack of some similar advantage that has hitherto made our manufacturer hesitate about giving comparatively liberal terms, a proper use of the trade acceptance and the facilities offered by the American banks established in foreign countries will save the situation.

For a complete treatise on the German banking system as applied to foreign trade see a bulletin issued by the Bureau of Foreign and Domestic Commerce entitled "German Foreign-Trade Organization," Miscellaneous Series No. 57, which can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., or from the district offices of the Bureau for 20 cents.

GOOD PACKING NECESSARY.

So much has already been written on the subject of proper and improper packing that anything which could be said here would probably be useless repetition. However, it is well to mention that a great deal of the exporter's reputation rests upon his ability to solve this problem satisfactorily. It resolves itself principally into putting his merchandise into boxes strong enough to withstand the knocking about at the terminals and yet light enough to keep freight and duty charges at a minimum where these items are figured on weight. Many of the small electrical devices are made largely of porcelain, which is comparatively fragile; consequently there must be some sort of cushion between the individual pieces or they will knock together and there will be a high percentage of breakage. This breakage not only causes extra expense to the recipient but leaves him without the necessary goods for his stock. If the factory undertakes to make good the loss on breakages due to careless packing it should remember that this is not merely a question of sending new material, but as the consignee has paid freight, duty, and landing charges on the useless as well as the salable material these expenses should also be allowed to him if he is to come out whole on the deal.

Lamps have for some time been arriving with practically no losses. Some foreign companies pack them in boxes or barrels with plenty of excelsior and straw, and burlap pads on the external cover, but this method is gradually being replaced by the use of cartons or special composition knock-down boxes which are light in weight but elastic and more than strong enough for the purpose. They will not do, however, for heavy articles such as small motors unless protected by an outer box or crate of wood.

PACKING MACHINERY, WIRE, ETC.

All machinery should be bolted to stout skids and in addition braced to the box so that no heavy parts are left unsupported to swing, pendulum like, when the box is dropped on its side, thus bringing all the strain on the holding-down bolts. In Buenos Aires the boats tie up to the wharf and all unloading is done by modern cranes, so there is comparatively little rough handling. Later, however, the machinery may be sent where no cranes are available and it is well to have it packed to withstand hard usage.

There is no way of assuring that a piece of machinery will be kept upright all the time, but if this is highly desirable it should be packed so that it is much easier to handle in this position than in any other, and this will go a long way toward securing the desired result. One manufacturer stenciled a large box with the design of a chain to indicate unmistakably how the lifting slings should be placed, but unfortunately he left some projecting skids which made it possible to lift the box in another manner. That was exactly what was done, with disastrous results to the machinery which it contained.

Wire is generally packed in rolls, even for domestic shipment, but a more compact roll than the one usually used would take somewhat less room and arrive in better condition. Burlap wrapping should also be used rather than paper, as it is more durable. The slight sav-

ing in freight and the neater appearance are appreciated by the customer and the slight extra trouble is well worth while.

A saving can sometimes be made by strapping together several small items of one kind, as dispatching charges are based on the number of packages regardless of size. Each manufacturer should study such points with particular regard to his own product to see how it best lends itself to economical but secure packing.

SUGGESTIONS ON PACKING.

Where an article is trying to compete with or replace one which has long been on the market it is very important that it be packed as nearly as possible like the latter. For example, a certain number of meters of wire per coil or a certain number of lamps per case may be desirable if they are to be resold to small dealers who are accustomed to calculating prices on that particular basis. It is one of the first principles of successful business to assist the customer and not to oppose him, to give him what he wants and not try to force him to take whatever happens to be in stock; and this principle should be adhered to even more strictly in foreign trade than in domestic, as our most formidable competitors have made big advances by attending to just such details.

In general, conditions surrounding the handling of freights in Argentina are as good as in other countries and extraordinary packing, such as the use of tin lined or extra substantial boxes, is seldom required unless the goods are to be reshipped to some remote section. It is always wise, though, to consult with the customer in case of doubt, as he can advise regarding the requirements, knowing the destination and probable treatment to be expected. If he asks for something out of the ordinary it is because he has some good reason for it and every effort should be made to comply with his request.

MARKET FOR ELECTRICAL GOODS.

The demand in Argentina for electrical goods of all kinds is larger than in any other South American country and for a normal year may be computed as being at least \$7,000,000. Considering the prosperity of the country and the fact that all lines of import have dwindled in the last few years to a small percentage of the normal, this figure may be exceeded for the first year or two following the peace treaty. In 1913, the year of greatest imports, the total amounted to \$9,756,234, and of this sum the United States furnished slightly less than 6 per cent, or goods to the value of \$577,126; while Germany, for many years the leader in this market, furnished over 50 per cent, or more than \$4,890,000 worth. In 1917 the conditions were reversed, and the United States furnished one-half of the imports, but the value was only \$1,375,499, as the total was scarcely more than one-quarter of the 1913 total. With this continuous falling off in imports for several years, it is evident that there is going to be a greater amount of buying than ever, once market, shipping, and financial conditions become more nearly normal. American goods have become known to a much greater extent than ever before, and it should be comparatively easy to retain the proportion of the business which we now enjoy if the trade is properly handled.

It must be observed, however, that the great amount of European capital invested in electric plants, railroads, and tramway systems and the influence of the business houses which have been established in the market for many years are powerful factors favoring the return of the trade to its original channels, and it must not be expected that we can keep our present share without earning it by hard work.

The greatest field is for lamps, meters, small motors, wire, and wiring devices, including a low grade of insulated conduit. After these come accessories for underground cables, porcelain insulators, telephone apparatus, and a large number of devices which have a small but steady sale.

The most important factors in developing this trade are the investment of capital, the establishment of agencies or branches, and especially the presence of a larger number of American salesmen and engineers. The difficulties and competition met with in this market are not likely to decrease in the near future and it is imperative, therefore, that we work against them more vigorously and cater to the trade more intelligently than in the past. Only firms or combinations with strong financial backing, willing to devote much of their energy exclusively to foreign problems, can make any appreciable progress toward maintaining effectively the lead which is now ours.

CENTRAL STATIONS.

There are estimated to be over 350 central stations in Argentina and a list of 230 is published by the Asociación Argentina de Electrotécnicos. It will be noted that many of them are of 150 kilowatts capacity or less, so that until they are materially enlarged there will not be enough current to permit the use of electricity for anything but lighting. The first thing necessary for the establishment of these plants is a contract with the municipality for the public lighting. Such contracts are made for a period of 20 years, renewable an indefinite number of times, and with this as a basis the company is assured of a certain income which justifies it in beginning operation. It can then solicit as much private load as it desires and in this way build up a profitable business. As long as its service is satisfactory it has the field to itself, since no one else cares to enter without some definite assurance of what load can be obtained; but instances have occurred where cooperative companies have been formed to compete with stations that have neglected the customers' interests. People in general are quite alive to and appreciate good service and advanced methods of administration.

FUEL USED.

Steam engines are still the chief type of prime movers, although Diesel engines are gaining rapidly in popularity because the petroleum obtained from the Government-controlled fields of Comodoro Rivadavia is suitable for use in the crude state as it comes from the wells. There are no local coal fields, and with one or two exceptions there are no sources of hydraulic power, consequently the use of internal-combustion engines received considerable impetus a few years

ago when an abundant supply of fuel was promised from national wells. Crude petroleum then sold for 27 pesos (\$11.46) per metric ton of 1,000 kilos (2,204.6 pounds). In January the price had been raised step by step to 110 pesos (\$46.71), but there was no alternative to its use, as there was practically no coal available. Other fuels are also very much used, the principal ones being wood, sawdust, and wheat bran. The German-owned station in Buenos Aires is using wood for over half its production, having had to change completely the systems formerly in operation for handling and burning coal. The Compañía Italo-Argentina has designed a special type of feeder for blowing sawdust and bran into the unmodified firebox of its oil-burning boilers, so that both of these fuels are successfully combined with petroleum in the proportion of four parts of bran or sawdust to one of petroleum.

It is a common thing to put into the municipal contracts a clause providing for an increase in price of current which the company may charge with a rise in the price of fuel. In Buenos Aires, for instance, the companies can increase this price $1\frac{1}{4}$ per cent for every 25-cent rise in the cost of a ton of coal piled in their storage yards, the base price of coal to be between 7 pesos gold (\$6.755) and $8\frac{1}{2}$ pesos gold (\$8.20) per metric ton. On the other hand, the price to private consumers must be reduced from time to time according as the annual production of kilowatt hours passes certain limits set in the contract. We thus have the peculiar condition that the municipality and the tramways, which have contracts containing the above clause, are paying for current in bulk as much and even more than many persons pay for house-lighting service.

TENDENCIES IN OPERATION.

There is a noticeable tendency toward the formation of operating companies to take over small plants, there being several such companies with eight or more plants, and a number with two or three. The object of this is obviously to secure greater economy in operation and administration, and it appears to give results that are very satisfactory to the companies, although there have been instances where the inhabitants of the places where these small trusts operate have complained that they were being exploited and have even erected opposition plants.

Another pronounced feature of central-station control is the waning interest in municipal ownership. Many plants are still run by municipalities, but no new ones are being acquired and several are on the market. Where it has been impossible to sell, the municipalities have been glad to rent for a term of years, indicating that sooner or later all the plants will have passed into the hands of private concerns.

COMPAÑÍA ITALO-ARGENTINA DE ELECTRICIDAD.

The newest central station in Buenos Aires is that of the Compañía Italo-Argentina de Electricidad, which received a concession from the municipality of Buenos Aires in 1912. This concession expires on December 31, 1962, at which time all grounds, buildings, machinery, distribution systems, and accessories which were installed in the first three years after approval of the plans for the original

station of 15,000 kilowatts revert to the municipality without payment on its part. In case, however, the municipality considers it inexpedient at that time to take over the operation of the plant, it may have the option of prolonging the concession for 25 years, whereupon the municipality will receive in addition to the 6 per cent of the gross income which the company now pays as part of the compensation for the concession, 15 per cent of the profits of the company. At the expiration of the new contract all property of the company is to pass to the municipality without any reimbursement. All capital which the company invests after the first three years will be recognized by the municipality annually in accordance with certain terms of the contract, and an amortization of 2 per cent per annum will be paid to the company until the expiration of the concession, at which time any amount still due to complete the amortization will be paid either in cash or in municipal bonds at the option of the municipality. Should the company establish a power house outside of the municipality, but for the purpose of furnishing current within its limits, it also shall become the property of the municipality. The company is prohibited from alienating or transferring the concession and from fusing or associating itself in any form with other electric company or companies supplying public lighting which are already established, but this does not prevent it from joining with companies which may be established in the future. In no case, however, may the company in any way make common use of the plant or distribution system of the other companies now established.

The main generating station is known as the Usina "Pedro Mendoza" and is located near the docks, thus facilitating the handling of fuel and supplies. The motive power is steam which is furnished at 200 pounds pressure and superheated to 350° C. by semivertical tubular boilers made by Franco Tosi, an Italian firm, and equipped with feed water heaters and "Green" economizers. The fuel used is crude petroleum from the native oil fields at Comodoro Rivadavia, but sawdust or bran has been used in cases of necessity with excellent results.

DESCRIPTION OF PLANT.

The capacity of the plant is 31,200 kilovolt amperes, the equipment consisting of three Tosi turbines, each being coupled to a Brown, Boveri & Co. three-phase generator having a normal rating of 6,250 kilovolt amperes, 7,000 volts, 50 cycles, and one turbine with a 12,500 kilovolt generator. All generators have direct-connected exciters, while for emergency purposes there is a 600-ampere-hour storage battery. The switchboards were constructed by Brown, Boveri & Co. and are located in galleries at one side of the station. They are constructed along very modern lines with reserve bus bars, bench control, and unusually ample protection against various classes of line disturbances. Among these one of the most interesting is a series of reactance coils between the generators and the line, the coils being constructed of iron wire instead of copper on account of the greater damping effect of the former material. From the central station to the distribution system there are eleven 10,000-volt, three-phase cables of 70 square millimeters conductor cross section, laid in conduits and terminating in the several substations located at convenient points

throughout the city. The total length of high-tension underground cables is approximately 75 kilometers (46.5 miles) all of them having been furnished by an Italian factory (Pirelli & Co., of Milan). Space has been provided for an increased number of cables whenever required by growth of the load.

Current is sent from the generating station at 7,000 volts, three-phase, 50 cycles, and is transformed by synchronous converters in six substations into direct current, 225 volts. The equipment of a typical substation consists of two or more six-phase regulating pole rotary converters of Brown, Boveri & Co. make, and all the necessary apparatus for starting and operating. Between the transformers and converters there are reactance spools so proportioned in relation to the winding of the converters that with changes in load, the direct-current voltage varies in the same manner as that of the direct-current generators which are installed in the substations. In this manner both may be run in parallel in order to take care of any peak or unusual load.

These latter units, of which there are at present 13, consist of "Tosi" Diesel engines, direct connected to a 500-kilowatt, three-wire, 250/500-volt generator.

PUBLIC LIGHTING SERVICE.

Public lighting to the extent of 2,000 arc lamps, or their equivalent, is taken care of by the Italo-Argentina company, nearly all by means of multiple circuits of direct current, 225 volts, which is also the voltage for house lighting. According to the concession the voltage is not to show a variation from the standard greater than 3 per cent and as a consequence some care is exercised to see that it is kept within this limit.

LOW-TENSION CURRENT.

Low-tension alternating current is supplied to certain customers, the most important one being the Government, which has made a 12-year contract with the Italo-Argentina Co. for the current which is used on the wharves and docks of the port of Buenos Aires. These circuits are 3-phase, 22 volts, 50 cycles, and are fed from seven substations located within the limit of the port works. The equipment of each consists of one or two immersed transformers with radiation fins, cellular type, high-tension switchboard with time and overload relay control and low-tension board with the usual switches, fuses, and meters, the maximum capacity being furnished by three 400-kilowatt units.

The low-tension distribution is all placed underground, the main feeders being lead covered and steel armored. Of this type of cable 300 kilometers (186 miles) are installed and of distributing cables 800 kilometers (500 miles). Separate circuits feed public lighting, approximately 150 kilometers (93 miles) of cable having a cross section of 10 square millimeters being now in service. This is practically the maximum of this type which will be required for the present, as the lighting contract calls for 2,000 arc lamps and that number is already being operated from the company's lines.

A private telephone system connects all substations with the main office so that notices of breakdown or trouble can be reported and necessary steps for repairs taken at once.

COMPAÑÍA ALEMANA TRANSATLANTICA DE ELECTRICIDAD.

In 1896 a concession was obtained by a German company for the operation of an electric plant in Buenos Aires. At that time there were already in existence two companies generating alternating current, one generating direct current, and several small companies operating street railway lines. The Compañía Alemana Transatlantica de Electricidad, which was formed in 1897, built a plant and was able gradually to absorb the smaller concerns, uniting their systems in one large network. At the same time the tramway companies amalgamated and an arrangement was entered into whereby the latter turned over their generating equipment in return for the street railway which the German company was then running. A long-time contract was entered into for the purchase of power by the consolidated tramways and this gave the first great impulse to the electric company. In 1907 the company received a concession from the municipality of Buenos Aires to run for 50 years, or until December 31, 1957, at the end of which time it must turn over to the Government without cost all buildings, lands, and machinery in perfect running order.

In 1908 and 1909 it constructed its present plant, which has eight steam turbo-generators whose total capacity is 65,000 kilowatts which, combined with the 23,000 kilowatts of the "Boca" plant and the capacity of the several smaller stations that are still in operating condition, gives the company a possible total of fully 100,000 kilowatts. In addition to this there are accumulators having a two-hour discharge rate of some 22,000 kilowatts. A part of this battery operates on the 460-volt lighting circuits and the rest on the 550-volt trolley. They are located at different points throughout the city, approximating in a general way the centers of distribution. The electrical machinery is practically all German made, some of the smaller units having come from Switzerland. Storage batteries, cables, converters, and transformers are all of German manufacture, and there is no likelihood that the company will purchase any other type.

DISTRIBUTION SYSTEM.

Current of both 25 and 50 cycles is generated because the two systems had each attained such importance previous to the erection of the new plant that it was necessary to keep them both. The former is transmitted at 12,500 volts and the latter at 13,000 volts by underground cables to various rotary converters and transformer substations from which the light and power circuits are fed with twenty-two 550-volt direct current and 225-volt, 3-phase, 50-cycle current, the former principally in the center of the city and the latter both in the center and in the outskirts and new sections. A large amount of power is also sent to the substation of the Cía. de Electricidad de la Provincia de Buenos Aires, which operates in several of the suburbs of Buenos Aires. The total length of feeder and distribution cables is estimated at over 5,000 kilometers (3,100

miles) and is constantly increasing, due to the competition of the Cía. Italo-Argentina. The company has over 100,000 service connections and 115,000 meters. Public lighting requires a capacity of 4,000 kilowatts and the Cía. Anglo-Argentina de Tramways a maximum peak of 15,000 to 20,000 kilowatts, according to the season of the year. The batteries are supposed to be of great assistance in economical operation inasmuch as they help materially in carrying the peak, which frequently rises to 40,000 kilowatts, or to double the normal average load, in less than two hours. Twelve thousand or more are furnished by the batteries, which obviate the necessity of getting more turbines into service. They are recharged in the early morning hours and during the day float on the line ready for any emergency load.

The Cía. Alemana Transatlantica de Electricidad is a part of the organization known as the Deutsche Ueberseeische Elektrizitäts Gesellschaft, of Berlin, a company formed by German capitalists to exploit electrical companies in foreign countries and furnish an outlet for German-made goods. To the same people belong also the central stations in Valparaiso and Santiago, Chile, as well as some smaller plants in Argentina and one of the tramway companies in Montevideo.

BUENOS AIRES PROVINCE CO.

The Compañía de Electricidad de la Provincia de Buenos Aires, Ltda. (Electrical Co. of Province of Buenos Aires, Ltd.) is an English and French stock company with boards of directors both in London and Paris, the former having charge of its technical affairs. Having purchased small stations already in operation this company now provides the lighting for some twelve towns in the Province of Buenos Aires, the current sold monthly amounting to 800,000 kilowatt-hours. For the suburbs of Buenos Aires this current is all generated by the Compañía Alemana Transatlantica de Electricidad and transmitted at 12,400 volts to transformer substations belonging to the Compañía de Electricidad de la Provincia de Buenos Aires, Ltda., which has the concession for the public lighting of the several municipalities. It also distributes the current for private lighting and power but does no installing or wiring other than that necessary for extending its lines to the primary of the customer. All distribution is by means of overhead wires and the circuits are 225 volts, continuous or alternating current, depending on whether they are fed by current generated in the company's own plants or by current purchased from the central station in Buenos Aires.

The company has published a set of regulations which govern all installations for private lighting, from which the following are extracts:

Entrance of the current.—The conduit which may be necessary must be located so that all wires enter to the meters; the conduit used should be of spiral steel, with corresponding bends; the company will install the conductor up to the exit bushing.

Fuses.—All fuses of 3 amperes or less shall have between terminals a distance of not less than 20 millimeters and for fuses of greater amperage not less than 25 millimeters.

Cables, wire, and flexible cord.—No conductor except flexible cord may have a cross section of less than $1\frac{1}{2}$ square millimeters. The permissible current-carrying capacity of conductors up to 50 square millimeters cross section is 2 amperes per square millimeter.

For passing through walls, insulating conduit shall be used and porcelain bushing shall be located at both entrance and exit.

For crossing the open ceiling iron conduit will be necessary. Wooden molding is absolutely prohibited. Flexible cord shall have a minimum cross section of 0.65 square millimeters and must be protected by a fuse on the wall and the terminal shall be soldered.

Every drop shall have its rosette on the ceiling.

The joints shall be soldered and properly insulated.

Every conductor shall be protected electrically by a covering of vulcanized rubber; if it is wire or cable which is to be installed on insulators or in the open air, this shall have a minimum thickness of 0.6 millimeter, and if it is for conduit work it shall have a minimum thickness of 1 millimeter.

Every branch circuit or drop light shall have a fuse before the snap switch.

Every device shall be of a type which will assure the insulation necessary to avoid a leakage to ground or danger of contact.

Voltage of the motors.—Motors up to 2 horsepower shall be of two or three wires; for motors above 2 horsepower the local office of the company must be consulted.

No motor will be permitted whose starting current exceeds 50 per cent of the current used with full load.

RAILWAY ELECTRIFICATION.

The Ferrocarril Oeste de Buenos Aires, Ltd. (Western Railway of Buenos Aires, Ltd.), an English company, has been working for some time on the electrification of the suburban section of its main line. On the harbor front of Buenos Aires it has constructed a handsome power house which has a capacity of 18,600 kilowatts in three 3-phase, 25-cycle British Westinghouse turbo-generator units of 6,200 kilowatts each. The current is generated at 2,500 volts and immediately stepped up to 20,000 for distribution to various substations. The switchboards are equipped with all modern protective and control devices for switching on the high side of the line and are from the factory of Siemens Bros.

All control apparatus function from 110-volt direct-current circuits fed by two 65-kilowatt motor generator sets and two 250-ampere-hour storage batteries. There will be two 500-kilowatt rotary converters to supply power for the locomotives which will be used in the yard about the power house.

A fourth generating unit can be installed in the present building, which is designed with particular regard to possible future expansion.

The generating station which furnishes the current for operating the electrified section of the Central Argentine Railway is located at Canal San Fernando, 28 kilometers (17 miles) from the center of Buenos Aires. Four Parsom turbines, each direct connected to a British Thomson Houston 3,300-kilovolt ampere, 25-cycle generator, produce the current at 2,500 volts, which is stepped up to 20,000 for transmission by means of three conductor, lead-covered, steel-armored, underground cables to the five substations. Three of these are located at convenient points along the right of way and feed the third rail with direct current, while the other two supply power to different work shops and car sheds. Each of the feeder substations contain three rotary converters of 1,000-kilovolt-amperes capacity with the necessary controlling apparatus for producing the 800-volt direct current which energizes the third rail.

BAHIA BLANCA CENTRAL STATION.

The Buenos Aires a Pacífico Railroad is developing a series of port works at Bahia Blanca and has erected a modern electric-lighting plant which furnishes current for public and private lighting and for the street railway. The handling of this business is done by a subsidiary company known as the *Compañía Sudamericana de Luz y Fuerza*. In the central station there are five vertical steam engines driving their respective alternators, which are rated at 1,000 kilowatts, 50 cycles, 6,600 volts, three-phase, with direct-connected exciter. For some time the company has been using petroleum as fuel on account of the scarcity of coal, so the automatic coal-handling machinery and feeding equipment has been dismantled. This was one of the few stations using weighing and pulverizing machinery for obtaining the best control over its operation.

From the generating plant the 6,600-volt current is sent to six substations throughout the city where it is reduced to the proper voltage for tramway and lighting. The low-tension alternating current is available for power as three-phase 380-volt current, and for light as single-phase 220-volt current, the neutral wire having been brought out from the transformer. Two refinements which show the modern methods employed are the telephone system connecting all substations with the main office, and the spare transformers of each type which are ready to be slipped into the place of those which prove defective. There are also all kinds of protective apparatus and controlling devices which are calculated to insure continuous operation. All machinery is of English manufacture, as the railroad and power plants are owned by English capital.

CÓRDOBA CENTRAL STATION.

Córdoba has several generating plants, the most important of which are the hydroelectric stations *Usina Bamba* and *Usina Calera*, of the *Compañía Luz y Fuerza Motriz*. The *Usina Bamba* was originally installed in 1898 by an American company, although some years ago it changed hands and now belongs to an English syndicate.

There are seven units with a total capacity of 3,880 kilowatts. The water wheels operate with a head of 95 feet. The generators are three-phase, 60 cycles, 700 volts, which is stepped up to 10,000 for transmission 18 miles to the substation, where it is reduced to 2,200 for distribution about the city. All the machinery came from the United States.

The *Usina Calera*, which was built in 1912, is also located on the *Rio Primero* a short distance from the *Usina Bamba*, and was erected when the latter could no longer keep up with the growing demand. There are four units, made by *Dick, Kerr & Co.*, of 1,000 kilowatts each, three-phase, 60 cycles, 10,800 volts. The water wheels were obtained from *Escher Wyss & Co.*, and operate with a head of 145 feet. The switchboards are *British Westinghouse* and are equipped with a *Tirrell* regulator for parallel operation of the generators on a combined lighting and street-railway load. Aluminum-cell lightning arresters protect the lines against very severe static conditions.

As a reserve, to be used in times of low water, the company maintains a steam plant with a capacity of 2,200 kilowatts. There are three units of Dick, Kerr & Co. generators direct connected to Bellis & Morcom high-speed engines. One of these is especially for tramway service.

A second company, the Compañía General de Electricidad de Córdoba, was formed in 1910 by local capital, as it was felt that the service given by the Cía. Luz y Fuerza Motriz could be improved upon. It has both a hydraulic and a steam plant, the former located on the Rio Primero farther upstream than either of the plants of the other company. It has two Brown, Boveri & Co. alternators, each of 300-kilowatt capacity and driven by Escher Wyss turbines operating at a head of 35 feet. The current is three-phase, 50 cycles, and is generated at 750 volts to be stepped up to 25,000 and transmitted 25 miles to the substations, which reduce it to direct current, 220-440 volts. In the steam plant there are two 375-kilowatt, 220-440-volt, direct-current, A. E. G. generators.

The demand for power for the many small industries in and around Córdoba is very great, as the rates are extremely favorable in comparison with the cost of other forms of power available, with the result that all stations are well loaded and undoubtedly will have to seek relief by expansion in the near future.

MENDOZA CENTRAL STATIONS.

The Empresa de Luz y Fuerza de Mendoza (Mendoza Light & Power Co.) generates current in one steam and two hydroelectric plants. Its total capacity is approximately 4,000 kilowatts, of which 2,000 are in the steam plant. This latter is necessary as a reserve in times of low water, since the flow in the Mendoza River is very variable, a minimum of 25 cubic meters per second and a maximum of 500 having been observed.

Current is transmitted at 5,000 volts over the distance of 10 kilometers (6.2 miles) from the plant to Mendoza, where it is distributed to the several substations. Not having sufficient power at its disposal, the Empresa is unable to take care of all the numerous industries and vineyards, many of which are now operating their own electric plants. In order to remedy this situation, work was begun on a new hydroelectric station in the Mendoza River at Cacheuta, some 35 kilometers (22 miles) from the city. It was intended to make an initial installation of 4,000 to 5,000 horsepower, with a later development providing for considerable more. The whole plan is held up now on account of the action of the provincial government in declaring null and void the concession under which the Empresa was working. The case is being contested, but until final decision is reached no further work can be done.

It is understood that the owners of the Empresa de Luz y Fuerza would be glad to sell it. This would seem to be a profitable investment, but the investigators of an American syndicate who have looked into it have not reported favorably. Copies of the balance sheets of the Empresa for 1915, 1916, and 1917, a copy of the statistics of the status of the company, and a copy of the law covering the utilization of the water of the Mendoza River for the production of electri-

cal power are on file and can be inspected at the office of the Bureau of Foreign and Domestic Commerce, Room 734, Customhouse, New York.

A company known as the Argentina Power & Railless Traction Co. was formed with English and local capital in 1913 to exploit a concession involving water-power development on the Mendoza River. In the beginning it acquired a small plant intended for the production of calcium carbide, but abandoned it on account of unprofitable operation. From this plant current was to be transmitted to Mendoza and also to several surrounding villages, but the ultimate aim of the company was to make an installation capable of producing 15,000 or 20,000 horsepower to be used in operating a railless street car system, and for all general power purposes. Activities have ceased on account of the war, and it is not known whether they will be resumed at a later date.

ROSARIO AND SANTA FE.

The Sociedad de Electricidad de Rosario has a very modern plant on the river front some 10 kilometers (6.2 miles) from the center of Rosario. It is unusually well built and the arrangement of the machinery is admirable. The total capacity is 18,000 kilowatts, supplied by four steam turbo-generators, two of 3,000 and two of 6,000 kilowatts, 50 cycles, three-phase, 6,600 volts. Room is provided for two more units when the load requires them. From the four substations the current is distributed at 550 volts, direct current, for the street railway, and 220-440 volts, direct current, for light and power, and also 110-190 volts, alternating current, for the same purpose. All machinery is of German make. Much of the distribution cable, of which there are nearly 300 kilometers (186 miles), is of aluminum and has been very satisfactory to the company.

There are three electric plants in Santa Fe, which is a city of 55,000 inhabitants. The largest belongs to the municipality and supplies current for light and power only. Steam turbines and engines furnish the motive power, driving four 230-460-volt, direct-current generators, with a total capacity of 2,600 kilowatts. This municipality has attempted to dispose of its plant, but without success, for various political reasons. The machinery is of German and Italian manufacture.

The Compañía Argentina de Tranvías y Fuerza, Ltda., originally furnished power to the tramways only, but later received permission to enter the lighting field in order to help its financial condition. The capacity of its plant is 1,500 kilowatts, of which part is generated at 550 volts for the railway service and the rest at 220-440 for lighting. The machinery is all of English make.

A third outfit of 250 kilowatts furnishes power only for the port works, which consist of a few cranes and winches. Diesel engines and Swiss generators supply direct current at 220-440 volts and a 300-ampere-hour, 440-volt accumulator assists in caring for peak loads.

TUCUMAN CENTRAL STATION.

The Compañía Hidro-Eléctrico de Tucumán has one of the largest waterpower developments in Argentina. It is located on the Lules River at San Pablo and feeds Tucuman, a city of 80,000 inhabitants,

and surrounding country. It was established in 1911-12, and has a possible capacity of 25,000 horsepower or more, although at present it is working with only 3,750 kilowatts, generated by three three-phase, 50-cycle, British Westinghouse alternators driven by Jens Orten Boving water wheels. A tremendous amount of water drains into the Lules River from the near-by mountains in the rainy season, and with proper conservation measures much could be stored for use in the dry season. Undoubtedly such measures will be taken as there are numerous opportunities for the sale of power at the cheap rates which such an installation would make possible. Tucuman is the center of the sugar industry in Argentina, 27 active mills, 4 of them operating refineries, being located in this district.

The current is transmitted to the outskirts of Tucuman at 44,000 volts, where it is reduced to 4,400 and sent into the city substation to be further reduced to 220.

There are two steam plants, with a total capacity of 2,000 kilowatts, generated by eight 220-volt, direct-current dynamos of various European makes. Two 300-kilowatt, British Thomson-Houston rotaries furnish current for the street railway. This plant will probably be in need of much new machinery during the next few years.

CHARGES FOR LIGHT AND POWER.

In most instances municipal ordinances determine the maximum rate which may be collected, making a sliding scale of reduction which must be effected when the production passes certain limits. In Buenos Aires the Compañía Alemana Transatlantica de Electricidad was originally allowed to charge a maximum rate for private lighting of \$0.16 Argentine gold (\$0.1544 United States gold) per kilowatt hour for the first 30 consumed in each month and \$0.08 Argentine gold (\$0.772 United States gold) for each kilowatt hour in excess of that amount. It was further stipulated, however, that when the sale of energy for lighting and power, without counting that sold for traction and public lighting, exceeded 40,000,000 kilowatt hours annually the company should lower its tariffs effective at that time 5 per cent for every 5,000,000 kilowatt hours or fraction over the 40,000,000. These reductions were to be applied in the year following that of the excess sale.

When these reductions amount to 30 per cent of the maximum tariffs stipulated no more reductions shall be made for this reason. As production has long since passed the mark set for the maximum reduction in tariff, the company can not now charge more than \$0.112 Argentine gold (\$0.108 United States gold) for the first 30 kilowatt hours or more than \$0.056 Argentine gold (\$0.054 United States gold) for each kilowatt hour over 30. Rates for private power, heating, lighting, and railways are subject to arrangement between the company and the consumer.

A similar tariff, with slight modifications, is in effect with the Compañía Italo-Argentina de Electricidad. As a sort of offset to this reduction in their rates both companies are allowed to charge the municipality an increasing rate as the price of coal rises. When the price of coal laid down in their yards rises above \$8.50 Argentine gold (\$8.20 United States gold) per metric ton the companies may charge an additional $1\frac{1}{4}$ per cent of the original tariff for every



FIG. 1.—CAPITOL BUILDING, BUENOS AIRES, WITH HOLIDAY ILLUMINATION.



FIG. 2.—GOVERNMENT AND PRESIDENTIAL OFFICES, BUENOS AIRES, WITH HOLIDAY ILLUMINATION.



FIG. 3.—PROMINENT STORES, BUENOS AIRES, WITH HOLIDAY ILLUMINATION.



FIG. 4.—NIGHT VIEW OF SUBWAY STATION, BUENOS AIRES.

increase of 25 centavos Argentine gold (\$0.241 United States gold). Thus all the increase in the cost of fuel is borne by the municipality for that portion which is used in producing the current which it consumes. The Cía. Alemana also has a long-term contract with the Anglo-Argentine Tramway Co. along the same lines with the result that the latter is now paying nearly 7 cents per kilowatt hour.

The average tariff of the smaller central stations throughout the country is 19 cents for light and 11 cents for power. The lowest rates are in the city of Tucuman, which charges 5 cents for light and 3 cents for power. No station makes any special rates for heating or cooking, although the Cía. Italo-Argentina de Electricidad is considering such a course when conditions become more suitable.

For comparison of rates for electric current with prices for gas, wood, and other fuels, see page 46.

LIGHTING.

In many cities there are electric and gas plants, both of which are used for public lighting. In general, however, gas is being displaced slowly, and its use is being limited to public lighting only. In many cases the gas plant belongs either to the municipality or to a company owning some store. During the last few years coal has become so scarce and expensive that the operation of gas plants has become burdensome, and there is a noticeable tendency toward changing all store and park lights as quickly as possible, substituting electricity for gas. Some of these changes are intended to be only temporary, but it is improbable that the gas lamps will ever be placed in active service again. When permanent electric fixtures are installed there will be a considerable demand for globes and other appropriate material.

With the improvements in electric illumination due to better filaments and especially to the advent of the gas-filled type of electric lamps, the popularity of electric lighting should increase, with a consequent demand for supplies. Also many of the present installations will be made over, the present equipment being replaced with new material. Many central stations are attempting to create a more general demand for lighting fixtures in order to increase sales of current. Dealers are always receptive toward new lines, but as few of them are familiar with the problems of improving illumination, it is practically impossible to market through them any device whose use requires special knowledge or experience.

HOUSE AND STORE LIGHTING.

There is little in house lighting that differs from our practices. The methods employed in the country districts and smaller towns are comparatively primitive, and the people are contented with the older forms of installations. In the cities where the tendency is toward the use of more and larger units, the number of consumers is increasing rapidly, and in consequence, the market for all electric-lighting material is continuously expanding. In Buenos Aires, about 10 per cent of the population are now active consumers of current, or about 160,000 out of a population of 1,600,000.

Store lighting is usually accomplished by a ceiling cluster or by ceiling drop lights for the most part singly spaced throughout the store. There is no evidence that any general effort has been made to apply the modern appurtenances which have been evolved for improving interior illumination of stores and offices. A small number of units especially designed for this purpose have been installed; but no well-directed and continuous effort has been made to increase the general use of such devices. At present they are being handled by general dealers who are not in a position to make special studies of the best methods of installation, and undoubtedly with higher grade representation a much larger number could be sold.

SIGN LIGHTING.

Unfavorable municipal ordinances handicap the development of the electric-sign business. Signs now in actual use, made locally of tin or sheet iron, are of two general types. The first is a transparent sign in the form of a box with painted glass sides, and the other is simply a set of letters spelling the name of the firm or the product. The most usual method of night advertising is by means of high-power lamps with hooded reflectors on the outside, showing the windows, and throwing light upon the display. This results in a combination of signs and window lighting which is attractive for the reason that the store front is brought into prominent display. As arc lamps were first used for window lighting, it was forbidden to have them inside of windows when goods of an inflammable nature were being displayed, and the custom of using outside lamps has continued, although nearly all arc lamps have given way to incandescent lamps of the gas-filled type. Imported signs would ordinarily be too expensive to become generally used, as the cost would be heavy by the time the freights and duties were paid. Head types of individual letters, however, could be carried in stock and used to make up individual signs, which might meet with some success if they were of such character that they did not conflict with the municipal ordinance, which prohibits the projection of signs over the sidewalk for more than a few inches. There is very little enthusiasm among the dealers for handling this material, and many of them would not take it up at all on account of certain disastrous experiences with similar articles in the past. It is hardly worth while to attempt to do anything along this line unless it is possible to secure a local representative, thoroughly familiar with the sign business, who would arrange with the municipalities for a modification of the public ordinances, and who could interest the central stations in making prospective customers a special price proposition, especially for the larger signs.

WINDOW LIGHTING.

Nearly every store and shop makes a pretense of lighting its window. This is usually done by hanging brilliant unshaded lamps in the center of the display space or by attaching several small units to each side of the window. Especially designed reflectors are rarely seen. The lack of agents competent to advise upon the location of especially designed units is largely responsible for the small sale.

Another obstacle to the widespread adoption of such devices by smaller stores is the fact that nearly all of them are equipped with rolling steel shutters, which are drawn at closing time, thus eliminating much continuous evening display. However, it is characteristic of business men to desire the same improvements that their neighbors have and this is a helpful factor in introducing scientific lighting units for which the market is gradually broadening out.

AUTOMOBILE AND TRAIN LIGHTING.

Prior to 1914 more automobiles of French manufacture than of any other make were imported. These were usually high-priced, inclosed types, and came equipped with electric lights for the interior, but with gas headlights. Electric bulbs have since been fitted into these gas lamps, and this works quite as well as having new lamps. A city ordinance prohibits the use of many lights or powerful headlights, and there is little use for them outside of the cities, since there are very few highways suitable for pleasure driving.

The later cars have largely come from the United States, and are fully equipped with electric lights when imported. This means that there is a continuous and growing market for the special types of automobile bulbs. Efforts to market them in the stores are meeting with success, and should be pursued more energetically than at present. A few garages are now handling them, but for the most part they leave such business to the automobile-supply stores. If properly approached, they would undoubtedly appreciate the probabilities of profit to be derived from the sale of such lamps and would aid in their distribution.

Practically all coaches on the steam railroads are electrically lighted, being equipped with storage batteries and individual axle generators. The system in most common use is made by an English company—American systems being practically unknown—owing to the successful operation and the popularity of the type now in use and the fact that the railroads are mostly owned by English companies. It is doubtful if American manufacturers could secure the adoption of their system to any great extent. Very few locomotives have electric headlights and this field, while small, offers an opportunity worth following up.

MISCELLANEOUS LIGHTING.

On the occasion of the celebration of the one hundredth anniversary of the independence of Argentina in 1916 Buenos Aires was very beautifully decorated and illuminated. All public buildings and many of the stores were outlined with varicolored lights, some of which were kept as permanent fixtures. The principal streets were hung with festoons, and in the parks set pieces were erected. Flood lights were used to illuminate the capitol building and the more prominent monuments about the city. All this stimulated interest in similar illumination throughout the country, so that in nearly every town some effort is now made to have electric display on patriotic or feast days. The equipment used is seldom more than makeshift, made by adapting to the purpose whatever equipment comes

to hand, but there is a growing demand for better devices intended for this particular purpose.

Nearly all churches now use electric lights in place of candles. The change has been made simply by installing several drop-lights or by fitting bulbs in the massive chandeliers. As ceilings are very high and interior halls dark colored, any system of indirect lighting is impracticable. However, it would be entirely feasible to use special lighting units to obtain greater illumination, and to arrange a plan of individual lighting of the altars which would be very effective.

FIXTURES.

In the smaller houses lighting units usually consist of drop-lights made up of a single lamp in a socket suspended in the center of each room; but these are being replaced with modern fixtures and chandeliers by those who can afford them.

The types of chandeliers most popular for large houses are of glass and crystal or massive-appearing bronze. The former used to come exclusively from Germany or Austria, as did all of the glass globes, beads, and other fixture accessories. All fixtures must be artistic and ornate, as the plain designs make very little appeal to the public. Up-to-date fixtures for indirect and semi-indirect lighting are beginning to find favor and will be much used in the future.

The importation of fixtures has practically ceased, as local establishments are making types more suitable to the market in quantities quite sufficient to take care of the entire demand. In many cases these fixtures are made from original designs, but more often are copies or adaptations of foreign designs. One fixture manufacturer in Buenos Aires employs over 100 people and has in his display room chandeliers, fixtures, drop-lights, and standard lamps having an estimated value of several hundred thousand dollars. Some of the best glassware was imported, but the commoner glass articles and all the metal work were made locally. In addition to this one big establishment there are many smaller factories, and it is safe to say that they will be able to prevent the importation of everything except articles of extraordinary types, since they can manufacture fixtures locally and sell them at prices lower than the prices asked for foreign types.

[Catalogues of fixtures made in Buenos Aires may be seen in the sample exhibit room of the Bureau of Foreign and Domestic Commerce, Room 734, Customhouse, New York.]

PUBLIC LIGHTING.

In all towns and cities where electric current has been available for a number of years public lighting is now or has been carried on by means of arc lamps, which are of various types. In the last three years there has been a decided movement toward the substitution for these arc lights of incandescent lamps, especially those of the half-watt type. This change is due largely to the many advantages which the incandescent lamp possesses over the arc lamp, but the fact that carbons and repair parts have not been coming from Europe as they did formerly has to a certain extent forced the adoption of the newer type. Before the war many arc lamps came from Germany, but when

this importation stopped the supply on hand was exhausted. The following figures of importation in the years from 1910 to 1917 are interesting as showing the decline since the war began: 1910, \$112,589; 1911, \$131,441; 1912, \$125,840; 1913, \$225,559; 1914, \$62,231; 1915, \$11,163; 1916, \$1,023; 1917, \$282. Municipalities and central stations are now quite willing to replace arc lamps with series or multiple incandescent lamps.

In nearly every case the arc lamps operated from multiple circuits, and consequently the standard 220-volt lamps replace them without difficulty and with comparatively little modification of the circuit. One of the few installations of series arc lamps is in Cordoba, where some 800 lamps are operated by 7.5-ampere, 60-cycle, constant-current transformers made by the General Electric Co. In some of the newer installations complete units consisting of lamp, hood, and reflector have been installed, but in general, in order to economize and make use of existing material, the mechanism of the arc lamp has been removed and the casing fitted with a socket suitable for the size of the incandescent lamp to be used. This process has been followed with high-power units, the lamp of 100 watts or less being installed with simple metallic or glass reflector, but no casing. The tendency toward replacement is such that it is doubtful whether any new arc lamps will be put into service anywhere in the Republic, and there is every indication that the present rapid decrease will continue until all have disappeared.

PUBLIC LIGHTING IN BUENOS AIRES.

In Buenos Aires several forms of public lighting are still in use. At the end of 1917 there were in service 17,703 gas lamps, which in June of that year consumed 1,172,415 cubic meters of gas; 2,429 alcohol lamps, consuming in June 35,810 liters (9,460 gallons) of alcohol; 3,201 kerosene lamps with a consumption in June of 40,180 liters (10,615 gallons); and the following electric lamps:

Arc lamps of—	
600 watts	4
480 watts	31
450 watts	2,897
Incandescent lamps of—	
2,000 watts	8
1,500 watts	54
1,000 watts	1,596
600 watts	1,284
400 watts	975
200 watts	286
100 watts	4
50 watts	1,100

The number of arc lamps has decreased from about 7,000 in 1915. The kerosene and alcohol lamps are in use only in the sparsely settled outlying districts where there are no electric circuits yet. The municipal contract with the gas company still has several years to run and the gaslights will consequently remain, but the policy is to replace lamps of all other systems by incandescent lamps of the half-watt or other types as fast as conditions permit. One of the policies of the municipality adopted at the time of the reorganization of the lighting department was to make a total replacement of the 6,000 series multiple-arc lamps (nine in series on 450 volts or four in seven series on 225 volts) in two years, at the rate of 250 per month, with the

metallic-filament, half-watt type of lamps operating on 225-volt multiple circuits. Owing to the many difficulties encountered in putting this program into effect there are still some 3,000 to be changed.

The following prices paid by the municipality in 1915 show that lighting by electricity is much more economical than by the other systems:

Gas lamp, 60 candlepower, 6.30 pesos (\$2.75 United States gold); alcohol lamp, 40 candlepower, 7.34 pesos (\$3.11); kerosene lamp, 7 candlepower, 3 pesos (\$1.27); incandescent lamp, 50 watts, 2.30 pesos (\$0.98).

All purchases for municipal use are made by contract in accordance with specifications issued for public bids. The time allowed between the date of publication and the opening of bids is too short to interest any one outside of the country, and this is done especially to encourage home industry or companies which have established local branches or representatives. All bidders must submit samples of the goods offered so that they may be tested by the technical laboratory of the city, maintained for the purpose of determining whether material and construction meet the specifications. The successful bidder is required to keep on hand a stock sufficient for several months from which the city can draw as the need arises.

The wires of the actual lighting circuits in Buenos Aires belong to the municipality, which does the installing, repairing, and operating, the electric companies furnishing only the current and the feeder lines to the several points of connection with the lighting network. All matters relating to public lighting in Buenos Aires are in the hands of the Dirección General de Alumbrado, Municipalidad de la Capital, with offices at Calle Moreno 303.

INCANDESCENT LAMPS.

Third place in value of imports of electrical products is held by incandescent lamps, the average annual importation for the last seven years having been approximately \$360,000. In 1913 only 7 per cent came from the United States, we being surpassed by England, Holland, and Germany, the last-named country being credited with 42 per cent.

There is little or no demand for any but the metallic-filament lamp, with round and pear-shaped bulbs, and only Edison screw bases are used except in trains and street cars. Both the Osram (English) and the Philips (Dutch) were formerly much more popular than American lamps, as it was claimed that they were superior to any other makes. Since the beginning of the war the Osram has practically disappeared, but the Philips is stronger than ever, largely because it is supplied in the gas-filled, half-watt type, for 220-volt circuits, in sizes below 100 candlepower. There is no factory in the United States willing to produce this kind of lamp. Presumably the reasons are good ones, but the result is that our European competitors are obtaining practically all the business of the great army of small consumers, who are demanding gas-filled lamps almost to the exclusion of all others. The representatives of the Philips line are also very active in their manner of handling it, are advertising extensively, and are undoubtedly entrenching themselves firmly against the competition of other European manu-

facturers later on. Their prices are practically on a par with American prices and they carry a very large stock locally, it being estimated that they now have some two million or more lamps piled up in warehouses ready to be drawn upon whenever needed. It would be difficult for a new firm to make any headway at present unless it offered a superior product and lower prices. One type of Swedish lamp has been brought in in fairly large numbers, but the stocks are stagnant on dealers' shelves or are being offered at reduced prices in order that they may be moved. They are poorly finished and many have crooked bases, while the glass is not without flaws. Japanese lamps have been offered, but up until the middle of 1918 none had been brought in except as samples. Italy was formerly doing an increasing business, but this has been completely stopped for more than a year.

LOCAL MANUFACTURE.

A local company was formed in 1916 to manufacture lamps in Buenos Aires, but was unsuccessful and went into liquidation early in 1918. It is said that the people interested were not trained to handle a proposition of this sort, and possibly in other hands it might have turned out differently. It would certainly seem that there is sufficient business in this and neighboring countries to warrant the establishment of a small factory, provided skilled labor and certain raw materials could be obtained cheaply and in sufficient quantities. A protective tariff would aid materially, and reciprocal low-duty agreements could undoubtedly be arranged with the near-by Republics. With the great interest which is being taken in manufacturing in Argentina, it is very probable that either local or foreign capital will again take up the matter and compete seriously with imported lamps.

PHILIPS LAMPS.

Following is a price list of Philips incandescent lamps:

Kind of lamp.	Usual number in package.	Candle- power.	Volts.	Prices in United States gold.	
				Single lamps.	Per hundred.
TUNGSTEN LAMPS.					
Pear, clear bulb.....	100	5-50	110	\$0.42	\$40.33
Do.....	72	10-50	220	.51	48.41
Pear, frosted bulb.....	72	10-50	220	.59	56.47
Spiral, spherical.....	100	50 watts.	110	.51	48.41
Do.....	100	50 watts.	220	.64	60.29
Do.....	50	50 watts.	110 or 220	.93	88.31
HALF-WATT LAMPS.					
“Arga”.....	100	25 and 32	110	.58	56.76
Do.....	100	50	110	.63	60.28
Do.....	100	32	220	.64	60.93
Do.....	100	50	220	.63	60.28
Do.....	100	100	220	1.27	121.01
Half-watt.....	50	200	220	1.70	161.32
Do.....	32	300	220	2.55	241.97
Do.....	12	400	220	3.03	288.67
Do.....	9	600	220	3.82	362.85
Do.....	7	1,000	220	4.67	440.61
Do.....	5	1,500	220	7.64	725.90
Do.....	3	2,000	220	10.19	937.30
Do.....	3	3,000	220	11.46	1,088.85

TABLE AND HALL LAMPS.

There is a fair demand for a high-grade ornamental lamp with glass or fabric shade for dining-room and boudoir tables and for piano or hall illumination. Shades of silk or other fabrics and many of the standards for hall and boudoir lamps are made locally, the field for imported goods being confined to ornamental glass or ceramic shades, bronze standards, and special types of desk or night reading lamps. Owing to the extensive development of the local industry, the future market will be confined to such material as can not well be imitated or displaced by substitutes.

The boudoir lamps are usually assembled from parts obtainable in any art store, the standards being small statues, porcelain vases, and the like, while the shades are fashioned by hand, professionally or at home, from various kinds of cloth and attached to wire forms which may be had in any number of sizes and shapes. A great many tall piano lamps, wall fixtures, and table lamps are made of wood and finished with a metallic paint which gives them the appearance of bronze or gold. These and the fabric shades are so much cheaper than those imported that all competition is eliminated.

HEATING DEVICES.

The climate of a greater part of Argentina is such that some means of heating houses and offices during three or four months of the year is desirable. Until recently very few people considered stoves or furnaces a legitimate part of the household equipment, and it was a regular custom for a host to receive a guest in a fur coat or ulster. This indeed is not uncommon to-day, but with the advent of modern apartment houses with central heating plants, the comfort of at least enough warmth to take the chill out of the air is coming to be appreciated more every day. Since there are thousands of houses and offices without means of heating, the oil stove, the gas log, and the electric radiator are finding favor in large numbers. The radiator, on account of its comparatively high cost of operation and the inefficiency of earlier types, has been the last to become popular, but now it is going ahead in a fairly satisfactory manner.

In Buenos Aires and in several other large cities the rates for current are relatively low, and this is precisely where the greater field naturally exists. In the smaller cities and towns the demand is very much less, but even there the people take their cue from the capital in the use of new articles, much the same as they do in fashions and styles. The price of kerosene, on the other hand, is going up, so that considering the greater convenience of the electric device, it has every advantage over the oil or gas heater. The most potent factor in the increased demand, however, is the extensive publicity, in the way of both display and demonstration, which it is receiving. This is the only successful way of creating a demand for a new article and the product of one manufacturer who has recognized this fact is now looked upon as the standard for all such articles.

The small devices such as irons, grills, and toasters are very well received, and on the strength of their satisfactory operation a market is being created for many of the less well-known devices such as hair curlers, heating pads, and water heaters. All such things

must have some one to push them, however, and especially to give practical demonstrations, as they are still far from being standard commodities which sell themselves.

COMPETITION.

European goods have never offered much competition as they have always been inferior to the American types alike in construction, operation, and finish. The life, too, is an important factor, as the circuits are all of 220 volts and great care must be taken with the material used to insure that it will stand up under the careless handling which it is likely to receive. The present high prices have encouraged the establishment of local factories, which are now turning out fairly large quantities of irons, grilles, luminous radiators, and a small type of focusing-reflector radiator. They are not so well finished as the imported articles, but they are sold at somewhat lower prices, and an effort is being made to push them on the ground that they are national goods. It is not at all unlikely that this movement will continue to gain headway as long as the manufacturers can undersell the foreign article and still make a good profit. There will always be a nucleus of purchasers who can afford and will prefer to buy an imported article, merely because the foreign label appeals to them, but they do not constitute the great mass of the buying public. Extra diligence is to be observed if we are to maintain our present supremacy in this line.

COOKING RANGES.

The only way by which cooking ranges can be popularized is for the manufacturer, the central station, and the dealer, but especially the first two, to carry on a continuous and intensive educational campaign with special inducements as to terms of payment and price of current consumed. This is appreciated by the German central station in Buenos Aires, which is manufacturing ranges on its premises and distributing them through the several branches which it maintains throughout the city and suburbs.

The Italo-Argentina company is not doing anything of this sort as yet, for the reason that it can not increase its capacity, but it is installing a new generating unit of 10,000 kilowatts and is planning to carry on the necessary special propaganda, in conjunction with certain dealers, as soon as conditions permit.

Too few ranges have thus far been installed to indicate positively which type will prove most popular, but the larger sizes will probably find the readiest sale at first, as ranges will be bought only by the wealthy families. Because of the high prices people in more moderate circumstances can not be expected to purchase even to the same extent that they would in the United States, for it must be remembered that whatever the cost in the United States it will be at least double in Argentina by the time the freight, duties, and other expenses have been added. Ovens are rarely used in ordinary house kitchens, as there are comparatively few dishes which are not cooked on top of the stove. It is quite likely that when the radical change from the present stove to the electric range is made, the valuable features of the oven, especially its economy, will appeal to the purchaser, and it is recom-

mended that ranges with ovens be displayed prominently among the rest.

It should be remembered that the class of help that has to use these ranges is of low intelligence, and every effort must be put forward by the designer to make them "fool proof." The types whose heating element has exposed coils are not so well adapted to the market as those in which this element is totally inclosed. The latter have the great advantage that the servants can not come in contact with live wires nor can they spill things on them. In either case, as the circuits are of 220 volts, something disagreeable happens—usually the elements burn out. For the present it would be well for manufacturers to make a more liberal allowance for free replacement of units, as experience shows that breakages are higher in proportion to their use with these types than with those of lower voltage.

Everything is favorable to a big development in the use of ranges. Coal, always expensive and very little used, is now practically unknown in cooking, while wood costs 90 cents per 100 pounds, alcohol and kerosene 35 cents per quart, gas \$3 per 1,000 cubic feet, and charcoal \$2.40 per 100 pounds. Although electric current costs from 8 cents per kilowatt hour for power to 25 cents per kilowatt hour for lighting in the several cities where there is a day service, and ranges might consume considerable current, the stations either have made special rates or are disposed to make them, so that, as in the case of novelties and the smaller heating devices, the extent to which ranges can be introduced depends largely upon the amount of energy spent in pushing them.

POWER.

In previous paragraphs we have pointed out the interest that is being taken in developing the country along manufacturing and industrial lines. There are to-day over 48,000 factories or shops, representing the manufacture of 150 different kinds of material, classified into 25 great groups, such as furniture, textiles, and food-stuffs. In Buenos Aires there were in 1915 approximately 6,500 establishments, with 13,000 motors, having a total capacity of 92,000 horsepower. During the same year over 1,200 new establishments came into existence, and they installed nearly 3,000 motors, with a capacity of 14,000 horsepower. Since then more factories have been started, and at present there is a brisk demand for small motors. Whether it will continue after the war is over will depend entirely upon how well local factories can compete with imported merchandise.

All coast and river ports are being modernized. The program calls for adequate freight-handling machinery, and wherever it can conveniently be used electrical operation is preferred.

For household use very few power devices have been introduced. No great demand for them can be created until the conservatism opposing them is broken down. This can be accomplished only by much effort and propaganda. This is but one of the lines where combined representation of related products can do more than any single house working alone.

MOTORS AND CONTROLLERS.

Nearly all power circuits are of 440 volts, direct current. Less numerous are the single and three phase, 50-cycle circuits (60 cycles

in Cordoba only). In these cases the voltages vary but are mainly 110, 190, 220, 380, and 440.

It was impossible formerly to sell a squirrel-cage, rotor-type induction motor in Buenos Aires, as the German central stations prohibited their use on their lines. After much endeavor an American company has succeeded partially in having this rule suspended, but the station still looks upon them with disfavor. The only valid reason is that German factories do not make this type except on special order, and consequently they would be at a disadvantage with their wound rotors and brush-lifting devices which are standard with them, even down to three horsepower. It is probable that the new national regulations being devised will take up this subject in a satisfactory manner.

There are no rules regarding forms or speeds, but motors above certain capacities must operate on 440 volts if the circuit is direct current. Below that they may be 220 volts. This limit is ordinarily two to three horsepower. Motors pay duty on weight and should be as light for their capacity as is compatible with good service. Every known make of European motor is in the market, making competition so severe that price becomes the all-important factor. European motors are rated on a 50° temperature use basis, and when ours are likewise rated much of the advantage which the former have had up to this time will disappear.

Our most severe competitors have been the German motor, especially Siemens and "A. E. G.", and the Marelli, a well-known Italian make. Manufacturers of these motors maintain their own branch organizations in Buenos Aires in order to be sure of proper representation. American motors are well liked and give entire satisfaction, so it is necessary only to furnish them fitted to local voltage and current conditions and with sufficiently low prices in order to get a good share of all business offering.

Ordinarily the cheapest possible form of starting switch or rheostat is the only one salable. There are no "safety-first" laws and few will go to the expense of making an installation of iron-clad boxes and similar devices. In fact, American plants, such as the meat-packing industry, are the only regular users of such "refinements," as these are considered. No statistics are available to show the types and sizes of motors imported, but by far the greater number are in sizes from 1 to 20 horsepower, constant speed, without inclosing covers. A limited number of motors of fractional horsepower ratings can be sold and these should generally be for 220 volts, direct or single phase, 50 cycles, alternating current. They are carried in stock only by a few of the larger dealers or factory branch houses, from whom the contractors or users buy direct. It is highly desirable, therefore, that such representatives have available as large a stock as possible. The success of certain European factories has been due, in a great measure, to their ability to make immediate delivery.

PORTS AND FREIGHT-HANDLING MACHINERY.

Many harbors are being equipped with freight-handling machinery and electric drive is chosen for much of it. There are large numbers of steam and hydraulic cranes now in use which may be converted at a later date. The following list of machinery in the present port

of Buenos Aires will give an idea of the extent to which power is now used. This does not include the moving belts and other grain-handling equipment.

	Tons.
60 electric cranes, movable-----	1½
44 electric cranes, movable-----	2½
24 electric cranes, movable-----	4
101 hydraulic cranes, movable-----	1½
21 hydraulic cranes, movable-----	2½
4 hydraulic cranes, movable-----	5
1 hydraulic crane, fixed-----	30
11 steam cranes, movable-----	Various
16 electric wall cranes-----	1
84 electric wall cranes-----	1½
51 hydraulic wall cranes-----	1½

The hydraulic cranes are nearly all English and the electric German. The new port will have an electric generating plant, cranes, capstans, and all modern machinery. This is being constructed by an English firm which has a concession from the Argentine Government. Other important ports which are being constructed or enlarged are Mar del Plata and Bahia Blanca. Numerous smaller coast and river ports are in need of similar improvement which will, no doubt, be undertaken gradually. The usual manner by which ports are developed is for the Government to issue a concession to a private firm giving it the right to exploit the port for a period of years in recompense for the improvements. The Government also does some work for its own account.

None of the factories or warehouses use the small, self-propelled truck or other apparatus for economical freight handling and there will be an opportunity for sales of such articles if the industries now in their infancy grow to a considerable size.

SUGAR FACTORIES.

In 1917, 30 sugar factories were actively grinding. The production was only 88,000 metric tons, and a better idea of their real capacity is had from the operations of 1914, when the output was 336,000 tons. Sugar factories are located in the northern provinces, principally in Tucuman, where there are 30. A report of the third national census of the amount of power used in all factories places it at 48,220 horsepower, divided as follows: Steam, 44,240; electricity, 2,115; hydraulic, 520; and the rest divided among gasoline, crude oil, and animals. Many mills are quite old and are equipped with antiquated machinery, all expansions having been made by adding here and there until they are in really bad shape mechanically. This condition is reflected in their production efficiency which averages only 7.8 per cent.

Two of the best examples of electrification are on the estates of Ledesma, in Jujuy, and San Pablo, in Tucuman. The latter installation was completed in 1914, using three-phase current, 50 cycles, 225 volts. One 260-kilovolt-ampere, vertical, steam-engine-driven generator furnishes the power, which is used to operate some 14 inclosed motors varying in size from 10 to 50 horsepower. Seven direct-connected vertical motors drive Weston centrifugals. The motors have short-circuited armature and start with star-delta switch.



FIG. 5.—ARTISTIC STREET LIGHTING STANDARD, BUENOS AIRES.

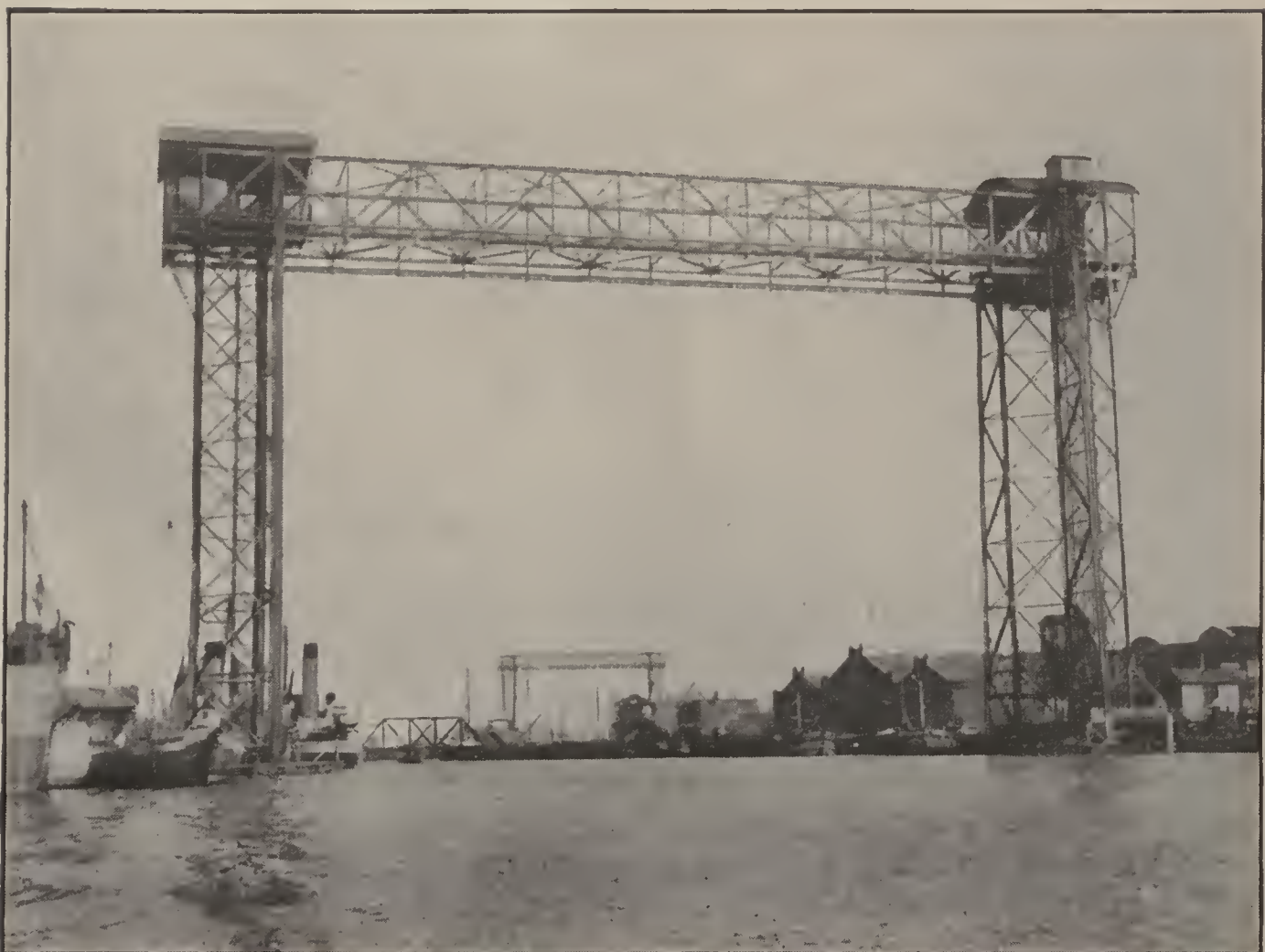


FIG. 6.—ELECTRICALLY OPERATED TRAVELING BRIDGES, BUENOS AIRES.



FIG. 7.—TYPICAL STREET CAR AND OVERHEAD WORK, BUENOS AIRES.



FIG. 8.—HYDRAULIC AND ELECTRIC CRANES ON WHARF AT PORT OF BUENOS AIRES.

The centrifugals are equipped with electric brakes. All electrical machinery is of German origin.

There is an opportunity for much more development of electrically-driven sugar mills, but only an experienced representative on the spot can take advantage of it.

TRACTION AND STEAM ROAD ELECTRIFICATION.

ANGLO-ARGENTINE TRAMWAYS CO. (LTD.).

Two street-railway companies operate in Buenos Aires, the larger being the Compañía Anglo-Argentina de Tranvías, Ltda. This is an English company which grew out of an organization formed to exploit a street railway and power plant combined. As noted on page 30, the Compañía Anglo-Argentina and the Compañía Alemana Transatlantica de Electricidad came to an agreement whereby the former turned over its central-station holdings to the latter and received from it the street railway which it was exploiting. A long-term contract was then made whereby the new exclusive tramway company should purchase its power from the central station at specified rates. It owns over 2,500 cars, including all types of motor cars and trailers, of which nearly all are equipped with electric brakes. About 1,800 are in daily service. Its extension of track is 600 kilometers (372 miles) and it contemplates an extensive program of expansion for the future. It carried approximately 290,000,000 passengers in 1917, exclusive of the underground line which carried about 30,000,000 more. Nearly all its equipment is English and German and, of course, there is a certain advantage in continuing to purchase new material and repair parts from the same factories; but recently a considerable quantity of American material has been used through force of circumstances. It is thus becoming familiar where before it was unknown, and a good share of this business will be kept after things have become normal again. New material can be brought to the attention of the purchasing department by communicating with it direct, in Spanish or English. Address, Cía. Anglo-Argentina de Tranvías Electricos, Avenida de Mayo.

The subway has a total length of 13.5 kilometers (8.4 miles).

The trains are of two or more cars, but single cars run out on the surface at the suburban end of the underground construction. The type of car used for subway traffic is entirely different from that of the surface cars, being arranged with two crosswise seats in the middle, the rest running lengthwise. They were made in Belgium and carry German electrical equipment. Current is collected at a potential of 1,000 volts from two overhead wires by means of a double pantograph trolley. Multiple-unit control is used and the car is equipped with a special type of coupling and flexible control cable to permit rapid connecting and disconnecting at the terminal station. There are 84 cars and 62 are in daily service. Owing to severe conditions of operation, the supplies and renewals necessary amount to a substantial yearly figure. Such materials are purchased by the department mentioned above.

Concessions are held by this company for the construction of further subways to connect the three principal railway stations, but an extension of time has been granted so that work does not have to be begun until a stipulated period after peace is declared, this being necessary in order to facilitate the financial arrangements and the acquisition of materials.

COMPAÑÍA LA CROZE DE BUENOS AIRES, LTDA.

The second important street railway in Buenos Aires is owned and operated by the La Croze family, under the name Cía. La Croze de Buenos Aires, Ltda. It operates about 400 cars over 150 kilometers (93 miles) of track and carried during 1917 approximately 50,000,000 passengers. Its concession gives it the privilege of laying tracks within a considerable section of the city which is now without them, and as its lines touch the principal points of the downtown business district it seems likely that it will be able to expand very materially as soon as it can get the necessary rolling stock and equipment. The company has its own generating plant in the city, but it is inadequate for the demands made upon it, and the company contemplates the erection of a new one on the outskirts, where there will be better facilities for handling fuel and supplies. Work has not been started on this yet, but when it is completed the company will probably electrify a portion of the steam road which it now operates. All the present equipment is American made, and includes some heavy double-track interurban cars of a late model.

The engineering and installation work was done by an English contracting firm, which still retains a certain interest in the company, although it exerts no influence in the purchase of supplies. American material is very favorably received, and any new device or apparatus should be brought to the attention of Director Gerente, Compañía La Croze de Buenos Aires, Ltda., Calle Corrientes 4000, Buenos Aires. Correspondence may be in Spanish or English.

OTHER BUENOS AIRES LINES.

A company called Tranvía de Buenos Aires a Quilmes was formed in 1905 to take over the operation of a small private line, the concession for which was first given in 1896. Owing to financial difficulties it was unable to complete its program of line extension until various arrangements for assistance were made with two German companies, the Quilmes Brewery and the Compañía Alemana Transatlántica de Electricidad, in 1906 and 1908. Since then it has been operating between Buenos Aires and Quilmes, a small suburb, over an extension of about 16 kilometers (10 miles) of track. A large part of its business is in hauling freight, and its rolling stock consists of 20 large passenger cars and 60 motor freight cars.

The Tranvías Eléctricas del Sud is a small road running through Buenos Aires from Piñeiro to Temperley, two suburbs, over an extension of track of 21 kilometers (13 miles). Rolling stock consists of 60 passenger coaches of various types and it carries about 3,500,000 passengers yearly.

The Tranvías del Puerto y Ciudad de Buenos Aires is a short line operating in the vicinity of the port and now under the administration of the La Croze company. It carried 4,000,000 passengers in 1917.

STREET-CAR LINES IN OTHER CITIES.

Street-car systems are operated by the several lighting companies in Bahia Blanca, Córdoba, La Plata, Mendoza, Rosario, Santa Fé, and Tucumán. Most of the rolling stock has English or German electrical equipment, Dick, Kerr & Co., British Westinghouse, and the Allgemeine Electricitäts Gesellschaft being the most prominent makers. The installations are in general well made and kept up. Overhead material is standard British or German and while it differs somewhat from our standards this is usually in minor details so that there would be no difficulty in using American material in most places. The great tendency is, of course, to continue purchasing the makes already in use, but wherever introduced American material has been very successful.

Conditions are not so favorable when it comes to substituting motors or control equipment and except in cases of emergency like the present there is little to encourage American manufacturers to expect very much business of this character. This does not apply to such standard material as tapes, armature and field spool wire, but it is probable that rarely could orders even for these be obtained except through a local representative. Operating as the companies are under difficult conditions as regards fuel, labor, etc., and charging fares no higher than companies in the United States, it is imperative that they refrain from experimenting with unknown and possibly unreliable material, and for this reason also good material once used is sure to continue in constant demand.

CENTRAL ARGENTINE RAILWAY (LTD.).

The Ferrocarril Central Argentino (Central Argentine Railway), an English company, has one of the largest and most progressive systems in the country. Two of its lines pass through the most thickly settled suburban district of Buenos Aires, where the traffic conditions are very suitable for electrical operation of trains. Both lines run from Retiro Station to Tigre, a distance of 28 kilometers (17.4 miles), along nearly parallel routes. One was started as an electric road in August, 1916, and the other will be changed over at some future date, according to present plans. Probably at the same time the main line will be electrified as far as Villa Ballester, a distance of 18 kilometers (11 miles) from Retiro Station.

The generating plant at Canal San Fernando has been described on page 32. The current is fed to the third rail at a potential of 800 volts. This rail has a cross section something like an inverted L and the current is collected by shoes making contact with the under surface of its upper flange. It is supported on porcelain insulators and the copper bonds are located beneath the fishplates. Underground cables maintain the continuity of the circuit where the third rail is interrupted, as at grade crossings. This line is double tracked throughout.

The car barns have capacity for 100 coaches and are equipped with a complete outfit of machinery for making all necessary mechanical and electrical repairs.

Automatic signaling is used only in the terminal yard at Retiro Station. Grade crossings are protected by hand-operated signals and standard types of gates.

The trains usually consist of units of one motor coach and trailer each, but the number can be reduced or increased as desired, as the control is on the multiple-unit basis. All the electric equipment was made in England by the British Thomson-Houston Co., or the British Westinghouse Co., or in the United States by a company closely allied with the former.

Material for repairs would naturally be purchased from these factories, but other articles that manufacturers desire to introduce should be brought to the attention of the chief mechanical engineers, Ferrocarril Central Argentino, Buenos Aires. Correspondence may be in English.

This electrification plan was laid out and the work supervised by the British consulting engineering firm of Merz & McClellan, which is also acting in the same capacity for the Ferrocarril Oeste de Buenos Aires, or Buenos Aires Western Railway.

BUENOS AIRES WESTERN RAILWAY.

This road is also owned by an English company and is engaged in electrifying its suburban lines for a distance of 22.3 kilometers (13.7 miles) from the Once Station, its Buenos Aires terminal. The generating station is practically completed and much of the track work has been finished, but the present condition of world affairs has halted progress on the work for the time being.

Direct current at 800 volts pressure will be collected from the third rail by the usual form of contact shoe. A train unit will consist of a motor coach and trailer. Shops for repair and small new construction work will be located near the center of the proposed total length of the electrified section. There will be four substations with an equipment of 10,000 kilowatts in motor generators and 1,700 kilowatts in frequency changes and motor generators. Substation machinery is coming from Dick, Kerr & Co. and the British Thomson-Houston Co. In addition to the motor coaches there will be several electric locomotives for freight trains. These are coming from the British Westinghouse Electric & Manufacturing Co. (Ltd.). All generators, motors, and cables are designed for ultimate operation on 1,600 volts when traffic warrants such a change.

For the city terminal the electric trains will occupy jointly with the cars of the Anglo-Argentine Tramway Co. the subway station at Plaza Once. Necessary construction work making this possible has been completed. A tunnel below the present subway will be used to transfer freight between the docks and Once Station, a distance of 5 kilometers (3 miles). Overhead trolley will be used in the tunnel and on the wharves instead of the third rail.

Manual signaling will be employed, this being considered adequate as the road is double tracked. As noted above, the electrification project is under the supervision of Merz & McClellan, British con-

sulting engineers, but all communications relative to possible sales of electrical or other material should be addressed to the Ingeniero Electrico, Ferrocarril Oeste de Buenos Aires, Ltda., Flores, Buenos Aires.

BUENOS AIRES GREAT SOUTHERN.

Plans are under way for electrifying a section of the lines of the Buenos Aires Great Southern Railway (Ferrocarril del Sud), a steam road which covers the Province of Buenos Aires, with city terminal at Constitución Station. It is not in a position to make public any information on this project but as it is an English company and rather closely connected with other Argentine railway interests the features of the two electrifications previously described will very probably be taken as standards for it also.

TELEPHONES AND TELEGRAPHS.

The first telephones were installed in Argentina in 1881 when two companies were established. In 1883 an American company was operating under the name "Compañía Unión Telefónica," when it with other existing companies was purchased by an English syndicate. Since then this combination has continued as the Compañía Unión Telefónica del Rio de La Plata. In the same year the Cooperativa Telefónica was established. Other companies have been formed in different parts of the country until now there are some cate. Since then this combination has continued as the Compañía Unión Telefónica del Rio de La Plata and the Cooperativa Telefónica, which together serve over 60,000 subscribers. Fully three-fourths of the subscribers of each company live within the Federal District. That there is room for expansion will be seen from the fact that the whole country has not more than 80,000 subscribers, which is only one instrument per hundred inhabitants, and in Buenos Aires, the Federal District, there are less than three and a half instruments per hundred.

Public pay telephones are not common. There are about 200 private branch exchanges, and intercommunicating telephones are being adopted to some extent. The future should develop considerable business along these two lines. Farmers' lines are also slowly increasing in number, though the great distances make for slow progress.

The railroad companies have a small number of telephone lines paralleling their telegraph service. There are no Government or municipal exchanges. Half the companies are owned by individuals and the other half are divided among groups such as partnerships or corporations. The Government exercises general supervision over them, but does not directly control them. By the terms of the concessions which it grants, it reserves the right to take over all property at the expiration of 30 years upon payment of a stipulated sum.

Toll-line service is not extensive, the longest line being 450 kilometers (280 miles). Buenos Aires has many lines extending into the near-by interior and is connected with La Plata, Rosario, and Mar del Plata, among other important places.

TELEPHONE INSTRUMENTS.

The instruments in all the small installations are of the local-battery, hand-magneto type, with one-piece receiver and transmitter. Desk and wall types are about equally popular. There is a continuous demand for material of this kind, but the individual orders are so small that purchases are made from local stocks rather than by direct importation. This means that it is imperative for a manufacturer to have a local representative, capable of effectively soliciting business, if he is ambitious for more than stray orders. In the keen competition of past years a Swedish company has been more successful than any other European firm, owing to its ability to sell good apparatus at low prices. The service required is not very high class, so the cheaper the equipment the greater the likelihood of doing business.

It is felt that as the country develops there will be several opportunities for safe investment in the establishment of new companies and in the consolidation under one management of small exchanges in various sections of the interior.

GOVERNMENT TELEGRAPH LINES.

The Dirección General de Correos y Telégrafos (Department of Posts and Telegraphs) controls and operates nearly all the telegraph lines throughout the Republic. They cover some 41,000 kilometers (25,000 miles), with over 130,000 miles of wire, counting multiple circuits. The annual increase during the last five years averaged 1,400 kilometers (870 miles) of line and 3,510 kilometers (2,180 miles) of wire. This development is less than it would have been had world conditions been normal. The apparatus used varies with the size and importance of the office, but they are largely European made, Morse type, plain or recording. All supplies of whatever nature are bought as a result of bids offered in answer to tender and specifications issued in September of one year and covering the requirements of the next. As only 30 days are allowed in which to put in a bid, and a stock must be kept from which immediate deliveries can be made whenever required by the Department, none but firms with local branches or representatives can compete for this business.

A copy of the licitation for 1918 is on file in the Bureau of Foreign and Domestic Commerce, Room 734, Customhouse, New York, and may be inspected by requesting catalogue 49.

GERMAN LINE TO URUGUAY.

The Compañía Telegráfico-Telefónica Nacional is a German company having telephone lines from Buenos Aires to Rosario and a cable and telegraph line to Montevideo (under the name Compañía Telegráfico-Telefónica del Plata).

UNION TELEPHONE CO.

The Compañía Unión Telefónica del Rio de la Plata (Union Telephone Co. of the River Plate) is the largest telephone company in Argentina, having upward of 50,000 subscribers, over half of whom

are in Buenos Aires alone. In the city stations central-battery energy is used with motor generators for charging and auxiliaries for ringing. In fact, it is well equipped in every respect except that the main exchange has far outgrown its location. New exchanges being erected follow certain standardized plans which permit the use of modern boards and cable racks and allow for ample future growth.

Most of the underground wiring is done with 600 pair cables. The company needs more cables and material of various kinds, but is refraining from further extension for the present, as a recent decree of the Argentine Federal Government specifies that the erection of new lines or the undertaking of other work after date of decree can be done only by concession for 30 years, at the end of which time the property reverts free to the Government.

All telephone expansion to-day is more preparatory for the future than designed to pay immediate dividends, and hence under such a regulation development is confined to localities where earnings will provide an amortization fund in addition to dividends.

Practically all material used is of one type, some being made in England and some in the United States. The company is English and purchases all large orders only through its London office. Considerable weight, however, is placed on the recommendation of the Buenos Aires management; consequently anyone interested in introducing material should correspond (in English) with the Chief Engineer, Compañía Unión Telefónica, Avenida de Mayo, Buenos Aires.

SOCIEDAD COOPERATIVA TELEFÓNICA.

The second telephone company operating in Buenos Aires is the Sociedad Cooperativa Telefónica. This is a cooperative company, as its name indicates, practically all the 8,000 subscribers being shareholders. Three-quarters of the company's lines are located in the municipality, the rest being in the smaller towns surrounding Buenos Aires. The switchboard in the main exchange is composed of 28 units of 100 numbers each, made by a Swedish company. A 600-ampere-hour storage battery furnishes the power for operating the boards and motor-driven magnetos are employed for ringing. At the subscriber's instrument ringing is done by hand magneto and the current for talking is supplied by local dry cells. There are no party lines and practically all circuits have metallic returns. In the smaller exchanges the switchboards are of various makes, the leading ones being Western Electric and Ericsson. Very little expansion is under way on account of the abnormal prices and the difficulty of getting any new material. These circumstances have also led the company to do a small amount of manufacturing in its repair shops, the articles made to date being drop cords, connection boards, and magneto coils. The majority of the telephones are of wall types, and of a well-known Swedish make, the rest being of various other European makes. The policy of the company is, in general, to obtain material at the best prices available rather than confine itself to one style or manufacturer.

All cables in the city are laid underground, the largest one being of 250 twisted pairs. From these cables the subscribers' service is

taken through outlet boxes located in each block or at convenient points of distribution. There is need of considerable material for repairs and development work, but, as the company will confine itself to the purchase of the smallest amount possible for the present, its deferred business will be worth obtaining. All communications, which may be in English, should be addressed to Mr. P. Gregorio Sloan, Administrador de la Sociedad Cooperativa Telefónica, Calle Cangallo 1206, Buenos Aires.

WIRELESS TELEGRAPHY.

The Government is the only user of wireless sets aside from the private companies that have concessions for high-power stations for international communication. A station is already under way which will talk with England and Australia. For supplying low-power sets, foreign companies have already entered the field, particularly the Telefunken, of Germany. Both Marine and War Departments have small sets of the latter type, but they are now buying another make. Amateur use of wireless outfits is not allowed, but the Marine Department, under whose care all wireless is placed, trains yearly a number of operators to fill the positions opened from time to time in the Government or merchant marine service.

All war and merchant boats have wireless sets which theoretically, at least, are never out of touch with one another or with the land stations along the coast. Several stations are located in the interior for maintaining communication with sections which otherwise would be nearly inaccessible. By means of these stations communication may also be maintained with the neighboring Republics that have their own wireless systems fairly well developed.

The Marconi interests are represented by the Compañía Marconi de Telégrafos sin Hilos del Rio de la Plata (Marconi Wireless Telegraph Co. of the River Plate). The Telefunken Co. also has a branch or a representative in Buenos Aires.

MARKET FOR SPECIFIC ARTICLES.

DRY BATTERIES.

There has been an increased demand for dry cells in recent months on account of the scarcity and increase in the cost of the Leclanché or sal ammoniac cell. They are used chiefly for doorbells, annunciators, and automobile ignition. American makes are generally well accepted, one in particular having given very good service, so that its name is now practically synonymous with the term dry battery. This is due entirely to the fact that the agent pushing it devotes practically his whole time to the products of that one company.

Most of the demand is for the standard No. 6 size, with either round or square outer carton. Some combination sets with three or more cells are also used, but they are rather too expensive for ordinary use.

The hardest competition comes from the Hellekens, a Danish cell of high quality. It has disappeared from the market temporarily, but will no doubt return and attempt to recover lost ground. On

account of its reputation and slightly lower prices in normal times it will surely succeed to a large degree, although continued activity on the part of American manufacturers who ship only selected, freshly made goods to counteract the effects of the long voyage through the Tropics will assure them a continuation of a large part of the business which they enjoy. There is a tendency among dealers to require special labels for each one, but such practice is hardly good policy for the manufacturer who can, if he has good agents, make his own trademarks known and demanded.

Several local establishments have attempted to make dry batteries but none has gone very far, and the movement probably will not constitute a real menace to the trade in the better grade of imported cell as long as there is only a very limited amount of capital and experience behind it.

STORAGE AND WET BATTERIES.

All central stations follow the European custom and install storage batteries of large capacity which float permanently on the line. Nearly all these are English "Tudor" or German "Accumulatoren Fabrik" type, both of which are handled by special representatives in Buenos Aires. All repair parts must come from them, and they are in an enviable position for securing all new business also. Moreover, they are apparently protected by patent rights or working agreements in the sole occupation of this territory.

Small sets are used on automobiles for starting and lighting, and there is a small demand for replacements and for equipping old cars or cars of European make, few of which have either starting or lighting systems of any sort. These batteries do not need to be of very great capacity, as they are used for interior and side lights only. There are no well-organized service stations to take care of the batteries, and this seems to have had an influence in holding back their adoption on a large scale. The types commonly offered for sale are the familiar 30, 60, and 120 ampere-hour lead battery, American made, European factories seemingly contenting themselves with the central-station type. The nickel-iron cell has lately been seen also, but comparatively few persons care to pay its greater first cost when its virtues are not explained in detail sufficiently to enable them to perceive that it may have compensating features.

The railroads and the Government use large numbers of Leclanché and sulphate of copper cells for their telegraph circuits. The Government alone has asked for approximately 70,000 rubber jars and 100,000 elements, which will be its requirements for 1918. These are always bought as the result of a public call for tenders, but in order to encourage local firms the Government allows a period of time for answering which is sufficient only for houses located in Buenos Aires.

Telephone companies in the larger cities have small central-energy plants for much of their service, but a large number of magnetos and local-battery instruments are yet in use. Until recently Leclanché cells have been most used in this service, but there is a general movement toward the use of dry cells, particularly where the individual user owns them and has to replace them when they are worn out.

CARBON BRUSHES.

Since nearly all central stations furnish direct current there is always a good demand for carbon brushes of various sizes and grades. A local factory makes such material as one of its specialties, but the quality leaves much to be desired, and consequently the imported article is more in favor. Nearly all the power circuits are of 220 and 440 volts, with the customary 550 volts for tramway service. Alternating current is being extended very rapidly in the industrial districts in and around Buenos Aires, but even with this there is still a field for brushes, as the motors are practically all of the slip-ring type.

The Government uses a considerable number, especially in the Navy Department, and has published a report giving in detail the number, size, and quality of every type used in its arsenals and on board its flotilla. This report is a standardizing compilation or catalogue for the use of the Navy Department in calling for bids and of the electrical trade in making offers. On account of the great diversity in dimension it is more convenient to stock the carbon in sheets and cut it to meet individual requirements than to carry a supply of each type already made up. One of the larger brush-manufacturing companies has its own staff in Buenos Aires, while several others are represented more or less actively. [The above-mentioned catalogue, in Spanish, may be consulted by interested parties upon application to the New York office of the Bureau of Foreign and Domestic Commerce, Room 734, Customhouse.]

CARBONS FOR ARC LAMPS.

With the decrease in the use of arc lamps there has come a decrease in the demand for carbons. Formerly the whole demand was supplied by Austria and Germany, those offered from other countries having been of a lower grade. Recently a local factory has been supplying carbon in fairly large quantities but of an inferior quality and at prices higher than those for the American product. Carbons are still required in quantities sufficient to make the business attractive for some manufacturers, but, except for the special carbons for the projectors of motion-picture theaters, the demand is rapidly falling off toward zero. These special carbons can be sold directly to the theaters through local agents or through the established houses which furnish the films.

CONDUIT AND ACCESSORIES.

The only kind of conduit which has been used very extensively is that known generally as "Bergmann tubing." Briefly this consists of a spirally wound strip of special paper impregnated with an insulating compound and surrounded by a closely wrapped and locked covering of thin brass or steel, usually the latter, with a galvanized or lacquered brass or lead finish to prevent oxidation. All buildings are constructed of brick or concrete, consequently the fire hazard is reduced to a minimum and Bergmann tubing makes a very cheap yet satisfactory conduit for all classes of interior work except where

the wires are to be embedded in the walls. Where the location is unusually dangerous or where there is an excess of moisture, and also for all embedded circuits, a light-weight enameled iron conduit, often little more than gas pipe or bed tubing, is used. Standard underwriter conduit is far too heavy and expensive, not only in first cost but also in freight and duty charges, both of which are based on weight. The only way of introducing it is through some contractor who appreciates the superiority of such conduit and is willing to demonstrate it to architects and owners of new buildings.

All the Bergmann tubing formerly came from Germany, but owing to the present scarcity Italian and Spanish manufacturers have taken it up, and brokers are even showing samples of locally made material. This last, especially, is inferior in every respect.

A light-weight, welded-joint, enameled iron pipe would be very acceptable, one weighing, say, about one-third of the underwriter standard tubing, and it need not be so well finished. Price is the all-important consideration, as there are no enforced regulations regarding its quality or construction. The cheapest iron conduit now used has an open joint and is not threaded, union being made simply by forcing into a coupling. This type is hardly worth reproducing, as it is not in popular demand.

The sizes are the same as those of our standard conduit, that is, based on nominal diameter, $\frac{1}{2}$, $\frac{5}{8}$, and $\frac{3}{4}$ inch, and each tube should be 3 meters (9.84 feet) long. The material should be soft enough to permit bending over the knee in the above three sizes, as the wiremen are accustomed to handling it in this way, and prefer to continue doing so. Elbows would be little used.

The pre-war prices of the iron or steel conduit most used, a soldered and threaded pipe, were \$4.62 per 100 meters (328 feet) for the $\frac{1}{2}$ -inch; \$5.34 for the $\frac{5}{8}$ -inch; and \$6.40 for the $\frac{3}{4}$ -inch. All prices were f. o. b. Hamburg.

The Bergmann tubing must also be of such a quality as will permit easy bending without collapsing. Special pliers are employed for this work. Measurements are for actual inside diameter, and run 7, 9, 11, $13\frac{1}{2}$, 16, and 23 millimeters (millimeter=0.039 inch). Only the 9 and 11 millimeter sizes are in common demand. The price per 100 meters, f. o. b. Hamburg, was \$2.19 for the 9-millimeter, and \$2.48 for the 11-millimeter sizes.

There is no sale for textile or fabric conduit, and very little for flexible steel.

For laying underground cables, in some cases a sort of brick trough, with wooden top, is constructed and in others the armored cable is laid right in the soil, its only protection being a wooden plank, laid 4 inches above it. Consequently, in repairing old cables, or laying new ones, the whole sidewalk is torn up. Tile or fiber conduits were proposed, but met with a cool reception, although it would not be surprising if one or both were to be adopted before long by the central stations, which are now put to a great expense and annoyance whenever any work of this sort has to be done. Manufacturers of suitable material would do well to send descriptive matter, preferably in Spanish, to Ing. Agustin Zamboni, director general, Cía. Italo-Argentina de Electricidad, Calle Corrientes 651, Buenos Aires.

DOOR BELLS.

There is nothing unusual about the kind of door bells ordinarily used. Both iron and wooden boxes are popular, with a slight preference for the former. In the cities practically every house has one bell and many have two, and there are also servants' bells in the larger houses. So the demand is relatively large. This is a line which has felt the effect of the lack of building during the last few years and sales should improve materially with the renewal of construction activity, which is now in evidence on a reduced scale. The greater part of the bells were formerly bought from Germany on account of low prices, which were well below American prices, our products holding but a poor second place. At present American bells are practically the only ones to be found on sale and they are proving very satisfactory. It is possible that they might obtain a firmer grip on the market if manufacturers were to offer some inducements to dealers for ordering a variety of spare gongs to fit standard boxes. The dealer could then afford to carry a much greater effective stock, and as long as American and European prices remained nearly equal he would not want to change to a different type while he still had a good stock of American bells on hand.

Buzzers are very little used, and should be brought more forcibly to the dealers' attention, as they have some advantage over the bells in price and cost of transportation.

Nearly all house circuits are supplied with direct current, hence bell-ringing transformers have practically no place. Both the sal ammoniac and the dry cell are extensively used for this purpose.

ELECTRIC VEHICLES.

At present there are three electric vehicles in Buenos Aires, probably the only ones in Argentina, no great efforts having been made to develop sales. Although at least three manufacturers of pleasure and commercial electric cars are represented in Buenos Aires, it is certain that nothing can be done without active propaganda, as the modern electric automobile is entirely unknown. Gasoline cars have been imported in considerable numbers and the purchasing public is very conservative in the adoption of new types. Every pleasure-car owner has a chauffeur and consequently can not be appealed to on the ground that the electric car is cleaner and easier to handle, nor does the usual advertising point that it is especially suitable for women have any force, since it is entirely contrary to local custom for women to drive automobiles.

The use of electric trucks will probably be longer in developing than any other form of transportation, although general conditions are very favorable for them. There is a great amount of delivery, both from wholesale to retail stores and from retail stores to customers, nearly all of which involves only short hauls and much starting and stopping. The street grades are very moderate in Buenos Aires, and this is generally true also for the interior cities. One of the central stations in Buenos Aires has interested itself in this subject, and has expressed an intention to establish charging stations and undertake an active campaign, in cooperation with one of the local representatives of electric automobiles, for the purpose of popularizing electric

vehicles in general. All attempts at introducing them in the past have failed, but it is possible that with the cooperation of the central station a demand can be created of which American manufacturers can take advantage.

Taxicabs are very popular, particularly in Buenos Aires, and it might be entirely practicable to establish a line of electric cabs which would be not only a source of profit in itself but an example of the efficiency and adaptability of the electric vehicle for city use. Low rates for battery charging could be obtained from the central stations and this could be made the basis of considerable advertising propaganda, contrasting the low cost and availability of electricity with the high cost and occasional shortage of gasoline. The price of gasoline to-day is approximately 60 cents per gallon, while electricity for battery-charging purposes could undoubtedly be obtained for 6 cents or less per kilowatt hour.

In considering Buenos Aires as a market for electric trucks, it should be borne in mind that reasonably good draft horses can be purchased in Buenos Aires for sums ranging from 50 to 100 pesos (paper peso = 42.4 cents United States currency), while in the country large numbers are to be had for 15 to 40 pesos. [For further information regarding Argentina as a market for automobiles see "Argentine Markets for Motor Vehicles," Miscellaneous Series No. 62, for sale for 5 cents by the district offices of the Bureau of Foreign and Domestic Commerce and by the Superintendent of Documents, Government Printing Office, Washington.]

ELEVATORS.

More elevators are used in Buenos Aires than in any other city in South America and for that reason competition is severe. No less than 30 factories are represented, although most of them have never done any business worth mentioning. An American firm has secured a large part of the best class of this business, principally because it has its own engineering office in Buenos Aires, capable of making up estimates for prospective customers and maintains an inspection and service department with a large stock of renewals. The field is mostly for moderate-speed freight and passenger elevators, with car switch, and for small, automatic, apartment-house types. Very few buildings have over six stories, the height of each story being 15 to 20 feet. In the smaller cities of the interior the market for elevators is less than in the capital and is easily supplied from there.

The demand for low-grade machinery is filled by European factories or by local constructors, several of whom are now profiting by the abnormal trade conditions. American manufacturers can not compete against this low-grade machinery unless they also omit all refinements of control, limit switches, and similar features thought necessary in the United States.

FANS.

For over half the year, fans are agreeable in offices and restaurants or other places where people congregate during the day, and they are being used in increasing numbers. Both ceiling and desk fans are popular, with the latter gaining in general favor. Special arrange-

ments have to be made for suspending ceiling fans on account of the height of the rooms. Extra-long pipe is desirable in some cases, although generally each problem is met in a manner that seems most suitable, standard equipment being adapted by the contractor to each job.

Oscillating desk fans of 12 and 14 inches are the best sellers. With some effort a smaller size, say of 6 or 8 inches, could be introduced for individual use, and this may be of the stationary type. The standard black-enamel finish is very acceptable for ordinary use, but various colors and more artistic designs would take very well for use in the better-class homes where the people are more inclined toward the French than the plain and solid American styles.

With the cool breezes which blow throughout the country nearly every summer afternoon and the cool evenings, there is relatively little demand for fans for home use. In common with many other household devices they are looked upon as superfluous or as an extravagance owing to the conservatism which still prevades the home and it will take a good deal of work to overcome this obstacle.

Competition has been chiefly with Italian fans which have been sold on price rather than quality. The largest distributor is the firm of Ercole Marelli, an Italian house maintaining display rooms and a competent staff of salesmen in Buenos Aires. Its product will not compare favorably with the best American product, either mechanically or electrically, but the price is more favorable to the purchaser and consequently it has been able to sell more than all other makers combined. Formerly German, English, and American fans were each sold in about equal quantities, sharing approximately 40 per cent of the total business. The American types are now preferred and they should maintain their present prominent place, provided the local agents are sufficiently diligent in pushing them. One make has gained particular favor on account of its pleasing design and good operation, and the personality of the agent handling it.

FLASH LIGHTS.

Comparatively little attention is devoted to sale of the flash light, so there is still room for a material increase. It seems to be regarded simply as a curiosity and not as a valuable article for everyday use. This undoubtedly is due to the fact that no attempt has been made to popularize it through persistent propaganda work, and that the principal places where it is exhibited are the novelty stores, where the freak shapes, such as imitation pistols are found, but the standard types are lacking. With all new and unfamiliar articles in a foreign market, a great deal of effort must be made before they are recognized and accepted as standard articles of trade. This has never been done in the case of flash lights, therefore there is no steady demand for them as yet. An American-made product has had the most success and will hold first position if care is taken to cater to the best trade only.

Needless to say, one of the requirements in building up a successful business in these lamps is that there must always be available a reliable supply of good batteries; otherwise the dealer can not push sales, as he knows that the inability to get renewals when needed

would prevent his customers from using the flash lights extensively or would make them lose interest entirely. Under the most favorable conditions a large percentage of the life of the battery is gone before it reaches its destination, as it is then already nearly 2 months old. If it is not feasible to make a special export lamp, therefore, care should be used in selecting those which are sent. To keep the dealers' stocks as fresh as possible frequent shipments in small lots are preferable to large shipments. In view of the present freight situation, and even in normal times, the parcel-post service could undoubtedly be used to good advantage.

HOUSEHOLD DEVICES AND NOVELTIES.

Very few people know or care anything about the large number of devices such as vacuum cleaners and laundry machinery which are available for home use. Many have been introduced but none has met with any marked success. Any real progress along these lines requires more effort than the average dealer is willing to make. His idea is always to make as much profit as possible from ready sellers and not to bother with trying to push articles which apparently are not popular, or with which he may not be any too well acquainted. It seems doubtful, therefore, if any business will develop which would warrant special attention from a manufacturer of these lines unless he should be able to join a selling combination such as has often been mentioned as a solution of the problem of how best to advance the interest of the small manufacturer in foreign trade.

INSULATORS.

No class of material shows more clearly than do insulators the European influence upon the electrical market. Before the war Germany and England were the only two countries which supplied them in quantities, consequently the sizes and shapes conform to the standards of those countries. The difference between these and American standards is particularly noticeable in aerial circuits of power, lighting, and telegraph lines. The countries mentioned use only white glazed porcelain insulators with grooved top and double petticoat, for straight and curved pins, these being much larger and heavier than the corresponding glass insulators of the United States. The latter are practically unknown, as the average annual importation for the last six years has been only \$400, and these were intended for one company, the only one which Americans helped to establish and which follows American practices more or less closely.

Glass insulators might compete with those of porcelain if they were properly presented. There must be an advantage in price, however, to offset the prejudice against them which most people seem to have. The use of glass insulators is an entirely new idea to them and they will not take to it at once. Perhaps an easier entrance into the market could be made by manufacturers of porcelain insulators, especially if they were to offer European types, provided that both in quality and price their products compared favorably with those already in the market. Careful study by the manufacturer would be required, and he should have a local agent who could forward samples and otherwise inform him regarding the kind most in demand.

The first type to experiment upon would be that used by the Dirección General de Correos y Telégrafos (Department of Mails and Telegraphs). The requirements of this department for 1918 were 30,000, which were called for by public tender issued September 6, 1917. It would be necessary to have a representative in Buenos Aires and to make up a number of insulators for stock, as only 30 days are allowed before the tenders are opened and "every bidder must be ready to deliver immediately upon being notified of the acceptance of his proposal at least one-quarter of the material adjudicated, and in addition must hold himself liable to fill at any moment the orders which the administrative director or chief of the warehouse office may make upon him."

The field for moderate or high tension insulators is negligible, as nearly all central stations have only low-voltage, direct-current equipment. The Buenos Aires 10,000, 12,500, and 20,000 volt circuits are all placed underground. Several stations in the interior have currents of 5,000 volts or over, the highest being 44,000 at Tucuman. The total length of such lines probably does not exceed 100 miles and there is little likelihood of extension, as very few waterfalls are available and steam or petroleum plants are naturally located as close as possible to the center of consumption. American high-tension insulators have been used to a small extent and are considered satisfactory as to price and quality, so the standard models have an equal chance in any new business which may develop. It could be obtained, however, only through a permanent representative, on account of its small volume and infrequent occurrence.

Tubes only are used for entrance, as the buildings are all of brick and plaster and do not admit of the so-called knob and tube work familiar in our frame houses. Short, straight tubes or tubes with curved ends for weather drops are the two popular types.

A great deal of interior wiring is done with flexible cord, which is run on small knobs. An average knob would be about one-half inch in diameter and one-sixteenth inch high. Since there is no regulation regarding size this becomes a question of price only. These knobs formerly came from Germany, as did most of the small porcelain ware, but recently Japan has been sending them in quantities and will probably continue to do so until it occupies the leading position. Cleats and split knobs are used only sparingly, European designs in both cases being the only ones known until recently.

Among the exhibits accompanying this report are the printed licitation of the Telegraph Department for 1918, a catalogue of German porcelain manufactures, and a few samples of small insulators. [These may be inspected at the New York office of the Bureau of Foreign and Domestic Commerce, Room 734, Customhouse.]

METERS.

Fixed rates are unpopular among central-station managers and there is therefore a very general demand for house meters. A majority of these are for direct current and for 220-volt circuits, with a capacity of 2 to 10 amperes. In Buenos Aires both the German and the Italian companies are largely committed to the purchase of meters from closely allied manufacturers. In the interior cities the choice depends largely on price and suitability of the individual meters.

Evidence that American meters did not fulfill both these requirements satisfactorily, or that the meters were not vigorously pushed, is shown in the import statistics for 1913. Out of a total of \$688,000 worth of meters imported, Germany's share was \$630,000. English makes were second highest, but after the war began did not succeed in obtaining first place; in fact, in 1915 they had dropped to fourth, being then only one-half of the imports from Germany and about one-fourth of the imports from the United States.

Several American meters are now being offered, and if it were not for the special connections of the two large central stations, Americans would be able to hold a good deal of their business in the future. It is doubtful whether they can do so with the reappearance of European meters in the market. Although quality is appreciated to a certain extent, the most important factor is the price, as the central stations look upon the meter as an expense rather than a productive investment. One mercury meter embodies both low cost and quality and has been particularly well received by all the large users. Competition arose unexpectedly some two years ago through the appearance of a direct-current, ampere-hour meter made in local shops. The manufacturer's name is Siemens-Schuckert (Ltda.), a branch of the German factory of the same company, and the meters are reproductions of standard types formerly imported by this firm. It claims to have made and sold over 14,000 meters up to May, 1918. The prices quoted are not lower than for some American meters, and it is not felt that these meters will compete seriously with ours in the future. For one thing, the new regulations being prepared will undoubtedly prohibit the use of ampere-hour meters on account of the possible abuses in overcharging customers.

Practically an identical meter is being made by a local company known as La Electro Metálica Argentina, or Dankert y Cía., Bartolomé Mitre 556, Buenos Aires. There is a possibility that this company has an agreement with Siemens-Schuckert to build their type of meter, perhaps with the idea that business might be obtained from firms which would refuse to deal with a German house. This company also makes a Ferraris-type, single-phase, induction meter. This has met with small favor up to the present, on account of both construction and price. In a recent proposal for meters presented to the Administración General de las Usinas Eléctricas del Estado in Montevideo the prices offered were conspicuously higher than those of the American meters which obtained the contract.

All meters should have a cyclometer dial or a direct-reading disk dial with only the correct figures showing at any one time. The standard American type is accepted now, but if manufacturers persist in offering this type only, they will undoubtedly hurt their future trade very decidedly.

[Illustrated pamphlets of the Dankert meters and a Siemens ampere-hour meter may be inspected at the New York office of the Bureau of Foreign and Domestic Commerce, Room 734, Custom-house.]

MEDICAL AND SCIENTIFIC APPARATUS.

Most doctors and dentists are very quick to appreciate advances in the quality of instruments designed for their use, the dentists in

particular insisting upon having the latest cabinets and wall plates. The leaders in their profession have all been educated abroad, many of them in the United States, and the greatest assets a dentist can have are a diploma from an American dental school and an equipment of American tools. This condition makes it relatively easy to sell good appliances, and several companies are already doing very well with X-ray machines, wall cabinets, and similar material. There is competition only with cheap German models, which few will have at any price. For handling these goods it is necessary to have a first-class local representative carrying them who is actively in touch with the trade in the various centers.

MISCELLANEOUS NOVELTIES.

Such devices as hair dyers, violet-ray tubes, and vibrators have been introduced and have taken remarkably well. Anything that affects the toilet or the person is likely to have a ready sale in Buenos Aires and to a smaller extent in the interior. Most of these things are strictly American, and there is relatively little competition from European factories. They can be handled best by specialty jobbers who distribute them through local electrical and hardware dealers or other suitable houses. Extensive demonstration work would pay manifold if followed up intelligently. All good barber shops now have one or more electrical devices, and the greatest appeal should be directed toward the home trade. It should be remembered that finish and artistic presentation mean a great deal and crude devices attract no attention whatever. The house circuits are nearly always of 220-volt direct current.

PANEL AND SWITCHBOARDS.

In first installations the switchboards are usually purchased from the company furnishing the generating equipment and the custom in the better plants is to match the original board when any extensions are made. Frequent departures from this rule are noted and a representative closely in touch with developments would find a fairly continuous demand for small boards. For the most part self-contained distribution panels without too elaborate an equipment of meters and switch gear are wanted.

American boards are recognized as giving very good service and few or no changes are necessary for a large part of the business to be obtained. European boards are usually made of marble instead of slate, and the former material is therefore practically a necessity in all repeat orders.

There is practically no sale among industrial establishments for control panels, as there are no regulations to require them and the general run of shopowners are content with any simple arrangement of starters and fuses.

Apartment houses and hotels use wall cabinets or panels to a small extent, the customary form of control being a group of separate snap switches and fuses mounted locally on a wooden base. The future undoubtedly will see the development of a good deal of business in these smaller lines.

PROJECTORS.

Only the light French motion-picture machines have had any permanent success. Both the Pathé and the Gaumont are popular because they are relatively cheap and especially because the reels can be exchanged very quickly with them. Very few houses have more than one projector, and the people demand a practically continuous performance, so that advantage is important. Heavy American machines, both hand and power driven, are carried in stock by the film exchanges, but have had very little sale. Just before the war a German manufacturer had launched a model copied closely after the French and was gaining an entrance into the market by his lower prices and longer terms of credit. With all European makers practically out of the market for so long a time, there is bound to be an increase in the sales as soon as they return. Detailed information regarding the construction necessary for a satisfactory modified American design could be obtained only through close study by some one familiar with these machines.

Searchlights and out-of-doors flood lights are in very small demand. The former are used only in the Army and Navy and are sold through special correspondence between the manufacturer or his agent and the Government. Flood lights have never been adopted for permanent use, and usually whenever anything of this sort is required, automobile headlights or homemade lights are used. There seems to be little chance of building up any sort of business in these lines at present.

PUSH BUTTONS.

Very cheap wooden and porcelain push buttons have been the only ones enjoying any extensive sale, although a few of very ornate designs are always in demand for better-class residences. Of these probably the most popular are the familiar ones imitating a lion's head or a flower, where the button takes the place of the tongue or the stamen. Other original designs would find a small market. Single or group buttons for office calls are popular, varied designs being required to suit different tastes, the simple bases both with and without cord holder being best liked.

Dining-room buttons for floor or table are unknown, as this field is occupied almost exclusively by pendant switches. These are usually the so-called pear switch or button, with wooden casing. A few are made of porcelain and come in a large assortment of fancy shapes such as a small statue, a flower, or a pair of cherries. The wooden pendant buttons are being made locally as the shapes are not very hard to copy and the European goods have not appeared on the market since the European supply has been shut off.

RAILWAY SIGNALING.

Signaling apparatus for railroads has not been used to any extent on either steam or electric roads. The only automatic or inter-connecting signals are found in the Buenos Aires terminal of the Central Argentine Railway. On the entire line of this and the other roads there are only approaching signals and signals at the several stations, all of these being simple hand-operated semaphores.

The system in the Buenos Aires terminal at the new Retiro Station is the product of the British Pneumatic Signal Co. and operates only over the yard and a short section of the many outgoing tracks.

Twenty-eight kilometers (17.4 miles) of the Central Argentine Railway, from Buenos Aires to Tigre, has been electrified. This is the only electric line in operation, aside from the local trolley service, although a second line is practically complete and two other roads are awaiting a more propitious time for beginning work on electrification of sections of their lines. The line now in operation has made practically no modification of the signals used by the steam road and there is little likelihood that the others will do so. All are owned by English capital and hence lean strongly toward English practice in this regard, so that it would be difficult to secure the adoption of American methods except by continual personal effort on the part of the manufacturer. Apparently, there is little real need for many refinements, for while there are a few express trains the traffic is not very heavy and is handled mostly by locals stopping at every station, so that dispatching by telegraph and telephone is considered to offer ample protection for the present.

In the subway of the Anglo-Argentine Tramway Co. in Buenos Aires, which has a present extension of 9 kilometers (5.6 miles), part of the signals are hand-operated and are made by Siemens-Schuckert Co., and part are automatic, of the McKenzie Holland-Westinghouse type. It is possible that the automatic may replace the hand-operated signals in the present tunnel, and they will no doubt be the only ones used in the future construction which the company is planning. During the rush hours the trains are run with a headway of as little as two minutes, and the automatic signals operate in home and distant blocks with provision for showing danger in both in case of any disarrangement of the system. Only in the terminal where the subway car goes out on the surface is there any complication, and here an operator in the switch tower controls all movements by means of a board showing in miniature all the tracks and the positions of cars thereon. Until new subways are built there will hardly be opportunity for the sale of new material of this nature.

THEATRICAL APPARATUS.

Theaters are generally very poorly equipped with electrical devices, either for the orchestra or for the stage. Nearly all have rather old-fashioned material, but many seem entirely content with it for two reasons—first, because the kind of play most frequently presented on the Spanish stage does not call for any fine lighting effects, and second, because all traveling companies carry with them any special apparatus which they require. Nevertheless, if this field should be canvassed by aggressive agents they could do much more than would seem probable at first glance. No one has given it any attention heretofore, as it is so limited at best that the average dealer does not see many possibilities in it. There is little chance of doing anything in this line through correspondence.

TOOLS.

A few machine shops throughout the country have individually motor-driven tools, but it is a far commoner practice to use a single

large motor or gas engine for the whole shop. The new tools now being installed frequently come with their own motor, and this is exerting a good influence on the owners of other establishments. They will want an equally good equipment as soon as they can afford it.

Portable tools have been introduced and adopted on a small scale. There should be a much larger sale than there is among the numerous garages, carpenter shops, and repair shops, but such a radical departure from the old established way of doing things needs a competent representative to show the advantages of the new way and demonstrate to a conservative proprietor why he should make a change.

TOYS.

A few stores carry a small stock of electric toys, but the demand is practically nothing, being confined almost exclusively to the families of foreign residents. It is greater now than ever before and may increase considerably in time as mechanical toys of all sorts are finding favor and the youthful taste seems to be turning gradually toward them through the influence of liberal education and contact with other nationalities. So many toys now come from the United States that our toys operated by dry cells may come quickly to the front. Nearly all home circuits are direct-current, 220 volts, so the usual toy transformer has no place, but it might be practicable to construct a voltage reducer for direct current which would take its place. This would aid in developing this field, as dry cells of relatively poor lasting quality cost at retail about 65 cents each.

TRANSFORMERS.

Argentina is not an alternating-current country, since nearly all stations distribute only direct current. The total capacity of all stations is approximately 250,000 kilowatts, of which probably not over 50,000 is distributed to the customer as alternating current. Stations in several cities in the interior have alternating-current generators.

Although all current generated is alternating, much of it is converted to direct current for use in street railways and for power and lighting circuits. The current is distributed almost entirely from large transformers, serving considerable territory, rather than individual transformers.

The largest users are the German and Italian central stations in Buenos Aires, and the companies operating both of these have a definite policy regarding factories from which they will purchase, so that American transformers have little opportunity.

TRANSMISSION LINES.

As there are very few hydroelectric plants the central stations are usually located in the towns, thus obviating the necessity for any but low-tension circuits. The three towns of importance with hydroelectric power are Córdoba, Mendoza, and Tucumán. The last-named has a line operating at 44,000 volts with a capacity of 3,750-kilovolt amperes. In Mendoza there is projected a line 35 kilometers (21.7 miles) long, of 40,000 volts, with branches to nearby

towns, but construction is held up temporarily by difficulties incidental to the war. In some of the smaller towns there are lines of varying lengths and voltages but the most important of all are the ones at Córdoba. Two separate companies furnish current to Córdoba and both have water-power plants. The Compañía de Luz y Fuerza Motriz has a station some 30 kilometers (18.5 miles) from the city and brings the current in at 10,000 volts pressure over a wooden-pole line equipped with a bell-type "Locke" insulator. There are duplicate circuits each consisting of six cables of seven strands of aluminum wire, the cross section of the cable being 56 square millimeters (about $\frac{1}{12}$ square inch). The capacity of the station is 8,000 kilowatts and it is the only 60-cycle plant of any importance in Argentina.

The Compañía General de Electricidad de Córdoba has a hydraulic station from which the current is transmitted 40 kilometers (24.8 miles) at a tension of 25,000 volts. The pole line is made of "Mannesmann" steel tubes and supports a single three-phase circuit of bare copper wire mounted on bell-type, porcelain insulators.

There has been some speculation regarding the possibility of bringing current from the Iguazu Falls on the boundary of Argentina and Brazil. According to all estimates there are enormous quantities of power available, one report stating the total to be 10,000,000 horsepower, but there is little probability that any plan for utilizing it will be taken up seriously in the near future. If it should be carried out it would call for a great deal of transmission line material.

As there are no other falls of importance which can be developed the sale of high-tension line material naturally has very little future. It will be confined to extensions to existing plants until such time as increased growth in population may warrant lines from the large cities to neighboring towns. At present all the 13,000-volt lines in Buenos Aires are underground, conforming to local ordinances. Modifications of these ordinances have been made recently permitting more overhead wiring than ever before, and it may be that similar permission will extend to the high-voltage circuits later on.

WIRE AND CABLE.

Of all the imports of electrical material, wire and cable have accounted for one-third to one-half of the value in each of the last eight years, the maximum importation occurring in 1913 with a total of \$4,772,530, of which \$2,000,000 came from Germany, about the same amount from England, and only \$115,000 from the United States. One of the leading factors in determining the source of imports was the presence of large amounts of German and English capital in a position to influence purchases, as the central station and the railroads which are electrifying sections of their lines accounted for much of the heavy cables, and the regular demand for small stuff was supplied by German and Italian wires of a grade inferior to the old code. Since 1914 the wire and cable coming from the United States has increased tremendously, but we can not hold this advantage permanently. A few factories have consented to make the cheaper grade of wire and cord and may always do some business

in that class of goods. But between two cheap articles there is no room for a discussion of anything but price, consequently all depends on whether we can sell a cent or two per meter cheaper than our competitors. In supplying the demand for a good grade of insulated wire our New Code will always find a field. If American wire and cable manufacturers desire to make advances in this field it will be necessary for them to supply a good grade of articles and be sure that their customers are entirely satisfied.

There will also be competition from local factories, as there are already some four or five small establishments turning out annunciator and other cotton-covered wire enough to supply the market. Plans are already completed by Pirelli & Co., a large Italian firm, for the erection of a good-sized plant to make all the kinds ordinarily used, which means that they are convinced that it will be more advantageous to do this than to continue importing as at present. Presumably at first they will have to bring in all their materials and do little more than assemble, but it is expected that if all turns out well they will be able later to work with locally purchased raw material. This firm is interested in the Italo-Argentina central station in Buenos Aires, and will normally get all its business in the same manner that the German factories are favored with all the business of the Cía. Alemana Transatlantica.

The larger tramway company in Buenos Aires, several of the companies in other cities, and the railroads are largely owned by English capital, and while they may purchase in the open market, much preference is given to home manufacturers. The Union Telephone Co., the only really important one, purchases almost entirely from an American company or its English branch. The telegraph lines are in the hands of the Government, and are equipped almost entirely with galvanized-iron wire. Other kinds, however, are included in the specifications issued from time to time, which can be bid upon only by firms having local branches or representatives. After the demand from these few large users comes the big demand for wire and cable for house wiring, which probably covers over half the wire imported. This should preferably be in metric sizes, but if it is not, then it should be marked with both the metric and the B. & S. gauge number.

PROPOSED WIRING REQUIREMENTS.

There are no rules in force governing the insulation which may be used, hence a very low grade has been commonly employed on account of competition in prices. Such wire is now being made by several factories, some of them in the United States. A small market will always exist for the best grade, however, and many people will insist upon it despite the greater cost. A few contractors are also urging its use upon the architects and their clients in an endeavor to elevate the standards of wiring. Material assistance may be given to this movement if the Committee on Rules and Regulations of the Asociación Electrotécnicos succeeds in securing the adoption by the Federal or even only the municipal authorities of the new requirements which they are now drawing up. The municipal authorities of Buenos Aires have recently adopted a new set of regulations, and that part which refers to conductors reads as follows:

These shall be insulated, and the insulation ought to reach at least 500 megohms per kilometer after immersion in water at a temperature of 15° C. for 24 hours.

The intensity of the current shall be such as will not elevate the temperature of the conductors above 40° C.

For conductors of copper of high conductivity (with a specific resistance of $1\frac{1}{2}$ ohms per meter and per square millimeter of section) the intensity admissible shall be 4 amperes per square millimeter for intensities less than 25 amperes; exceeding this limit those indicated in the following table shall be observed:

Section of copper.	Current kilometers.	Section of copper.	Current kilometers.
<i>Sq. mm.</i>	<i>Amperes.</i>	<i>Sq. mm.</i>	<i>Amperes.</i>
10	35	95	190
16	60	120	225
25	80	150	260
35	100	185	300
50	125	240	360
70	160	310	430

Conductors of copper having a cross section less than 0.75 square millimeter or with a diameter of, say, 1 millimeter should not be used.

ELECTRIC WIRE IN USE.

Considerable quantities of twisted cord are used, but of a type which is rather more flexible than our standard. This is preferred, as in a great many cases it is used for the suspension of a single drop lamp with counterweight, which does not operate smoothly on a cord with few strands. The wire should be tinned and, next to it, there should be a covering of vulcanized rubber; it hardly matters how thin this is. The insulation is noticeably poor, but the price is low and everyone is satisfied. The competition is with German and Italian and, lately, with Japanese factories, the last named sending extra flexible cord, but only with good insulation up to the present. One of the shipments noticed was from the Yokohama Electric Wire Works, and consisted of white cord having 15 strands of No. 30 B. & S. wire. It was packed neatly in rolls of 145 meters (158 yards), having a very presentable appearance, both in the roll and in the piece.

Standard round and grooved trolley wires are used, and sales should be very good once prices come back nearly to normal, as all companies have been using old wire for repairs, and before long will need considerable quantities for this purpose as well as for extensions. In many sections of Buenos Aires the service is hard on the wire and different grades have been tried with varying success, the ordinary hard-drawn copper apparently meeting general conditions quite well enough. The electrified sections of the steam roads are all equipped with third rail.

Insulated aerial feeders have not proved satisfactory, as the atmosphere contains such a large percentage of saline moisture that the covering soon deteriorates and drops off. A law is now being projected, therefore, which will permit the original installation to be made with bare wire, thus effecting a material saving in first cost. This will be applicable in the smaller cities and the suburbs of Buenos Aires. In the central part of Buenos Aires all feeders and distribution circuits must be underground, and thus there is a con-

tinuous demand for armored cables, which can be laid in the ground without ditches or conduits. All connections are made in underground chambers at street intersections and distribution wires run to each building from there. Whether cables laid in this manner will endure indefinitely remains to be seen, but if they ever give out and have to be replaced a total of several thousand kilometers of all types will be required, even if very little more is laid in the future.

WIRE FOR SPECIAL PURPOSES.

There are a number of medium and high tension transmission lines in the country, but there is relatively little tendency toward an increase because, as noted before, there are no new large water-power sites to be developed, and consequently the power plants are located as near as possible to the center of distribution. Two of the present lines are using aluminum wire, all the rest having regulation copper.

There is a small demand for a good grade of high-tension and armored automobile cable for ignition circuits, owing to the increasing number of automobiles being used daily. Only the recent American cars have electric lighting systems, but many owners are fitting them to older models for interior lighting or to replace the kerosene side lights, headlights being very little used, since, for lack of country highways, practically all night riding is confined to the cities.

Armature or magnet wire is used by all the lighting and tramway companies for making repairs. Recently, too, there has sprung up a demand for the smallest sizes for meter coils, as two local companies are devoting their energies to turning out an ampere-hour, direct-current meter and an induction, alternating-current meter. Aside from the needs of the tramway companies, however, the demand is very limited.

Makers of annunciator and other cotton-covered wires are buying the bare copper and the cotton from the United States and putting them together on machinery bought from Europe or constructed locally, although at least one of these firms is in position to draw the wire to any desired size in its own shops.

WIRING DEVICES.

No adequate rules for wiring exist. Each central station and municipality usually has some regulations but nothing comprehensive or of any particular value. This condition has permitted the use of numbers of cheaply constructed devices which would never be sanctioned in the United States. It is probable that they will be modified materially when new rules which are being drafted by the Asociación Argentina de Electrotécnicos are completed and adopted.

The most common practice in house wiring is to run wires or flexible cord on small porcelain knobs or through thin insulated conduit of the Bergmann type. In all old houses this is the only feasible manner on account of their construction, which is of brick or cement throughout. In new constructions a low-grade iron conduit is used and embedded within the walls. This often rusts away, but it leaves a smooth runway which protects the wires. For this class of work

our conduit would be admirably suited except that it is altogether too heavy and expensive.

The push-button switch is little used, although it is gaining in popularity now. The snap switch is used in nearly all cases, whether with open or concealed wiring. The tumbler switch is rarely seen. Practically the entire market to-day is supplied from the United States, one well-known make having been adopted as standard by the Government department of telegraphs. Before the war a large German factory had copied the exact design of this switch and put it on the market at considerably lower prices, with the natural result that it was seriously competing with the original. To meet this situation a very cheap switch modeled after a standard German design was made and launched on the market, the name "Cap" being used as a descriptive trade-mark. But it was not long alone in the field. The same Germany factory soon brought out an exact copy of the "Cap" switch and container, the prices quoted being lower than for the genuine. Only a few were sold owing to the outbreak of the war, but the design is listed and illustrated in the firm's catalogue for 1914-15, showing clearly that the intention was to introduce it as widely as possible.

This company listed all sizes of the imitation standard switch, using to supplement its own catalogue numbers those used by the original manufacturer in his own literature, so that a customer could order from Germany with the same nomenclature as from the United States.

[Several samples, invoices, and descriptive catalogues relating to the various articles mentioned in the foregoing report may be inspected at the New York office of the Bureau of Foreign and Domestic Commerce, Room 734, Customhouse.]

URUGUAY.

FEATURES OF THE MARKET.

Uruguay, one of the most progressive of all South American Republics, has an area of 72,000 square miles, and of its 1,148 miles of boundary line 668 lie on rivers and oceans. The country is gently rolling and in some places hilly, the greatest elevation not exceeding 2,000 feet. It is admirably adapted to cattle and sheep raising, and nowhere is there any large section which can not be tilled or used for grazing. The cattle industry has had a big impulse owing to the establishment of meat-packing plants in Montevideo and other localities, and it is the source of a large part of the country's wealth. Nearly 90 per cent of the exports of the country are made up of meat, hides, and the various by-products of the packing house and canning plant. There are at present 2 freezing plants, 1 extract factory, 3 canning factories, and 13 establishments for making jerked or salted beef.

The agricultural development of the country is not being neglected, and about 5 per cent of its area is under cultivation to the principal cereals. The Government takes a great interest in all things pertaining to the advancement of agriculture and cattle raising, and has established experiment stations and schools for the education of those engaged in these and derived industries.

There is an abundance of mineral wealth scattered over the entire country, and many mines have been exploited, though on a relatively small scale. Both iron and copper are found in various sections and large deposits are indicated. Coal has been produced but it is poor in quality and so far has not been found in commercial quantities.

CLIMATE AND POPULATION.

The climate of Uruguay is one of the most equable to be found anywhere, and this has much to do with the progress being made in the essential industries. It is also partly responsible for the high rate of immigration. The mean annual temperature of Montevideo is given as 62° F., with a minimum of 45° and a maximum of 79°.

Statistics for 1913 give the population of Uruguay as 1,280,000, but it is estimated to be nearer 1,350,000 now. Approximately one-fifth of the people are foreigners, Italians and Spaniards being in the majority.

In any consideration of the Republic as a market Montevideo must be regarded as the key to the country, as it is the center of importation and distribution for the interior. In fact it would be impossible to do direct business with any other town for lack of facilities such as banks, customhouses, and agents. The large houses are located in the capital and have their own representatives appointed by travelers attached to their staffs, who visit, with more or less regularity, all towns of any importance.

A majority of the inhabitants of Uruguay live in the country, but on account of the high average per capita income they are enabled to enjoy many city comforts on their ranches and country estates. There is no class of nonpurchasers, and consequently the market for various imported commodities is better than in many countries with a much larger population.

PROGRESSIVE TENDENCIES.

The general tendencies of the people are progressive, and they are usually quick to take up new ideas. In this they are encouraged by the Government, which is fostering the general welfare of the community in many ways, notably by obtaining competent directors and personnel for its various bureaus of investigation and research. Its international policy is well defined, and it is very liberal toward foreigners who wish to invest capital or take a personal part in the affairs of the country. Every year the number of free rural schools is increasing, and so are the facilities for teaching adults. There is a university for higher education and a national school of arts and trades, whose aim is to prepare persons for promoting the general progress of industries by becoming fit and capable workmen.

ELECTRICIANS' SCHOOL.

In order to train more of their employees the Government Department of the Central Stations maintains an electricians' school (*Escuela de Electricitas*), in which it gives theoretical and practical courses in mathematics, mechanics, electricity, and shop practice.

The subjects covered are presented in such manner that they can be understood by its linemen, station attendants, and salesmen. The school is open to any of the employees. The training thus given is already showing effects in the greater efficiency of the operating staff, and the Government thus has a nucleus about which it is building up the organization necessary to make a success of the Government ownership of the electric-lighting plants throughout the country. It is obvious that this training is going to be beneficial to the electrical industry as a whole, since in time there will be a better general understanding and appreciation of electrical installations on the part of independent contractors, as well as among the employees of the Government.

An interesting example of the progressive national spirit is found in the fact that the first system of public lighting by electricity in South America was installed in Montevideo as early as 1889.

BEST SELLING METHOD FOR URUGUAY.

Uruguay does not differ materially from Argentina in the way in which business can and should be handled. What has been said about credits and terms of payment in Argentina applies to the smaller country as well. One American bank has its own branch in Montevideo and others have responsible correspondents to facilitate collections and the furnishing of credit information.

Montevideo is the chief port of entry and the only city which needs to be considered by the exporter. The usual manner of handling

business in Uruguay is to secure the services of an active representative in the capital and leave it to him to canvass the small towns of the interior. This representative is sometimes appointed a direct agent, but more frequently he acts as a subagent, responsible to some company or person in Buenos Aires having the three River Plate countries, Argentina, Uruguay, and Paraguay, as exclusive territory. On account of the greater importance of the Argentine market, it is often easier to obtain a competent representative there than in Montevideo, although in the latter city there are several dealers in general lines of machinery and also some exclusively electrical dealers who would give satisfactory service.

One advantage in dealing with a factory branch or representative in Buenos Aires is that often in cases of emergency local stocks can be drawn on for quick delivery. The most suitable form of representation must be decided by each company for itself, but it would be a mistake to give the agency for Uruguay to a firm in Buenos Aires if the firm does not spend a fair share of its time in developing Uruguayan business. It is also to be noted that local representation in Montevideo makes a good impression on customers, as the people sometimes resent being considered as commercially tributary to Buenos Aires.

LANGUAGE—WEIGHTS AND MEASURES.

The language of the country, in which all correspondence should be conducted, is Spanish. The metric system of weights and measures was adopted legally in 1862 and its use has been obligatory since 1894. No other should be used on any documents or packages, and it is advisable to use it also in correspondence and catalogues. The port facilities are exceptionally good, but material should be carefully boxed, as usual for foreign shipment. The attention given to this point by American manufacturers in the last few years is producing results which are very satisfactory and complaints of bad packing are fast disappearing.

TRANSPORTATION.

There are in actual operation over 2,600 kilometers (1,615 miles) of railway, with approximately 800 kilometers (496 miles) more in course of construction. This gives Uruguay a greater mileage in proportion to its area than any other country in South America, and affords ample communication for the present. Projected lines would easily double the existing mileage, connecting Montevideo with all towns of any importance whatever. It is already possible to go from Montevideo to Buenos Aires and Asuncion by rail, making connections at the terminals at the river and crossing it in a ferryboat. Direct trains are run once or twice a week from Montevideo to Sao Paulo and Rio de Janeiro, connecting also with other cities of southern Brazil.

In normal times about 50 lines of passenger and freight steamers touch at Montevideo on their way to and from all parts of the world. Local lines connect the city with ports of near-by countries.

CHIEF INDUSTRIES.

Agriculture and cattle raising, the two most important sources of national wealth, do not of themselves require much power, but their

numerous derived industries do. The most important of these are the meat-packing plants, dairies, flour mills, and wine-bottling establishments, all of which are users of machinery and are among the larger buyers of electrical equipment. The packing plants are in the hands of an American concern, which purchases practically all its material through its head office, in accordance with specifications drawn up for its American plants.

Mining is carried on in a desultory way, but the Government department of mines is making thorough studies of the probable resources which can be worked commercially; and if it is found that these can be exploited on a considerable scale, a new market for machinery will be opened up. The demand is now practically nonexistent.

Manufacturing has long been carried on on a small scale, and many establishments have sprung up in the last four years. Their products cover a wide range, including such articles as pottery and ceramics, clothing, cement and bricks, cook stoves, furniture, paper goods, shoes, carriages and wagons, and musical instruments. Both men and women are employed, and wages range from \$1.20 per day for employees of lower grade to \$4 for those who are very skilled. The supply of good labor is increasing and keeping pace with the demand, this being due to the training received in the schools and shops.

An organization composed of the more important manufacturers and known as the "Union Industrial Uruguaya" was founded in 1898 to "unite and foster the work of artisan and manufacturer." Since then it has broadened the scope of its activities and now exerts much influence toward securing higher rates of duty on imported manufactures, etc. A plan which it is fostering is the establishment of a free manufacturing port or zone where foreign or native capital may be invested in industries which would be freed from local taxes and from import duties on all materials entering into exported products.

ADVERTISING.

It is necessary to advertise through the local dealers. They will make good use of counter and window displays and should be supplied with these and a variety of envelope stuffers, pamphlets, and other free literature in Spanish. Small stickers, calendars, and paper and envelopes are all used to good effect. Local newspapers and perhaps a magazine or two should carry a general advertisement of the products, supplementing any space the dealer himself may use. This need not be very expensive, as a new product becomes known quite easily, but the advertising should be continuous.

As an alternative to this, an exclusive agent should be appointed and given an allowance for pushing the goods. The success of at least one electrical device of American manufacture can be attributed in large measure to the persistent advertising carried on by the agent and dealers. It seems only fair that the manufacturer should pay for a part of the publicity and good will created for his trade-marked goods.

IMPORTS OF ELECTRICAL GOODS.

The following table shows the value of imports of electrical goods into Uruguay, by articles and principal countries, as given in the detailed statistics of the country, for 1915 and 1916:

Articles and countries.	1915	1916	Articles and countries.	1915	1916
Insulators of porcelain or glass.	\$801	\$1,155	Circuit breakers.	\$736	\$304
United States.	333	237	United States.	240	276
Germany.	159	338	Germany.	420	.....
Netherlands.	114	405	Netherlands.	77	.....
Spain.	91	114	Telephone switchboards.	54	217
Insulated electric wire.	9,318	8,761	Germany.	31	.....
United States.	5,816	4,307	United Kingdom.	23	136
Argentina.	378	848	Dynamos.	1,631	917
Germany.	1,208	.....	United States.	28	235
Italy.	808	3,081	Argentina.	949	648
United Kingdom.	524	195	France.	33	.....
Lighting fixtures and apparatus.	4,594	6,339	United Kingdom.	620	15
United States.	545	2,392	Electric motors.	13,193	11,040
Argentina.	277	771	United States.	.....	4,271
France.	638	1,927	Argentina.	.....	1,399
Germany.	1,924	304	Brazil.	.....	1,541
Italy.	161	.....	Germany.	50	.....
Netherlands.	105	.....	Italy.	13,143	3,828
United Kingdom.	712	944	Interruption.	2,869	2,968
Cables.	8,102	7,089	United States.	2,194	2,260
United States.	3,899	4,214	Argentina.	.....	380
Argentina.	695	1,651	Belgium.	103	.....
Italy.	1,066	465	Germany.	308	141
Netherlands.	501	.....	Italy.	39	186
United Kingdom.	1,521	618	Netherlands.	189	.....
Cases and fuse rosettes and accessories.	2,889	946	Lamps, incandescence:		
United States.	1,961	645	Carbon filament.	34,135	47,936
Belgium.	473	.....	United States.	5,384	34,801
Germany.	72	208	Argentina.	8,202	9,147
Netherlands.	250	58	Italy.	3,981	1,331
United Kingdom.	42	.....	Germany.	3,356	74
Electric bells.	110	741	Netherlands.	11,204	.....
United States.	63	634	Sweden.	186	.....
France.	.....	78	United Kingdom.	930	2,160
Netherlands.	47	.....	Metallic filament.	11,561	14,414
Conduit tubes.	2,655	673	United States.	1,184	4,999
United States.	195	.....	Argentina.	2,156	3,547
Argentina.	.....	234	Germany.	657	.....
Belgium.	111	.....	Netherlands.	2,799	2,153
Germany.	379	.....	Spain.	.....	2,046
Italy.	.....	438	Sweden.	1,448	.....
Netherlands.	111	.....	United Kingdom.	1,618	950
United Kingdom.	1,859	.....	Electric cells.	3,881	4,826
Electrodes for arc lamps.	11,389	346	United States.	3,409	3,488
United States.	371	172	Argentina.	69	824
Argentina.	289	173	Netherlands.	266	66
Germany.	9,937	.....	United Kingdom.	75	156
Netherlands.	635	.....	Lamp sockets.	673	1,200
Insulating tape.	1,525	1,358	United States.	253	794
United States.	1,035	992	Argentina.	.....	322
Argentina.	21	197	Belgium.	51	.....
Germany.	131	132	Germany.	188	.....
Italy.	326	.....	Netherlands.	151	.....
Electric meters.	11,380	3,311	Resistances and transformers.	153	.....
United States.	25	.....	France.	10	.....
Argentina.	21	225	Italy.	143	.....
Italy.	4,789	918	Telephones, complete.	2,001	3,487
Netherlands.	5,651	.....	United States.	418	1,470
United Kingdom.	74	2,167	Argentina.	391	833
Flexible cord.	3,023	8,021	Germany.	250	36
United States.	2,096	6,360	Netherlands.	507	.....
Argentina.	235	959	Norway.	397	.....
Italy.	430	624	United Kingdom.	37	1,146
Netherlands.	117	.....		

Articles and countries.	1915	1916	Articles and countries.	1915	1916
Wall sockets.....	\$292	\$317	Transformers for electric current.....	\$526	\$279
United States.....	44	178	United States.....	145	279
Argentina.....	44	139	France.....	13	.....
Germany.....	134	.....	Spain.....	331	.....
Netherlands.....	58	.....	United Kingdom.....	36	.....
			All other articles.....	14,518	7,780
			Total.....	142,009	134,425

With regard to these figures, it should be noted that Uruguayan statistics of electrical goods imports are divided into two sections, one of which gives figures for goods which are readily classifiable under the headings of the tariff, and the other figures for goods concerning whose classification there is question. The above table shows only the first section. The table following gives figures for the second section for 1915, but detailed figures for 1916 (total imports \$214,101) are not available:

Articles and countries.	Value.	Articles and countries.	Value.
Wire.....	\$16,001	Carbons for arc lights—Continued.	
Argentina.....	134	United Kingdom.....	\$166
Germany.....	15,852	Dynamos.....	6,204
Cable.....	47,550	United Kingdom.....	6,204
United States.....	10,430	Electric lamps.....	7,148
Argentina.....	5,878	United States.....	5,687
Italy.....	16,303	Germany.....	275
United Kingdom.....	14,939	Netherlands.....	379
Carbons for arc lights.....	18,811	All other articles.....	7,466
Argentina.....	166	Total.....	103,180
Germany.....	11,129		
Netherlands.....	7,350		

CENTRAL STATIONS.

The Government of Uruguay has decreed that all public utilities shall be considered State monopolies, and it proposes to take over their operation as rapidly as conditions permit. Considerable progress has been made in this direction with the electric-lighting plants, five of them having passed under the control of the Administración General de las Usinas Eléctricas del Estado (General Department of Government Central Stations). This department has its headquarters in Montevideo and administers the affairs of the stations through a central organization of capable engineers with local representatives at each of four other cities. Its successful management is due entirely to the policy which it maintains of appointing, as members and officials, only competent and intelligent men, without regard to political belief. All purchasing is done by public bids. All plants will soon be under their control.

In no other city of South America is there a more progressive development in the use of electrical devices than in Montevideo. The Government has equipped a large showroom with working models of practically every well-known device for the household, including several kinds of water heaters and ranges, and the usual styles of

radiator heaters. All these are arranged for convenient operation under conditions approximating those of actual service, so that the prospective customer is able to see at a glance just how they will work in his home and in many cases how much it will cost to run them. The result of this, coupled with the unusually low rates for current for cooking and heating, will be a demand for all kinds of material on a scale proportionately greater than in most other cities. Sales are not made from stocks, except in the case of cooking stoves, water heaters, or other apparatus requiring special care in installation and connection. Employees attend to the installation also in order to insure satisfaction both to consumer and central station. Possibly later on as contractors become more familiar with the devices, the activities of the show room will be confined solely to demonstration and propaganda.

MONTEVIDEO PLANT AND OTHERS.

The plant in Montevideo is one of the oldest in South America, having been established in 1889 with 148 subscribers. Its growth was gradual until 1906, when there were 3,029 subscribers, but during the last 10 years the number increased much more rapidly, so that at the end of the 1916 there were 29,203. This has necessitated a corresponding expansion in the generating equipment to keep pace with the demand, and the department has recently purchased in the United States a turbogenerator of 10,000 kilowatts capacity, which will enable it to retire one or more of the older engine-driven sets from service, except for reserve. Even with the smaller units with which the department has been working up to the present, the cost per kilowatt hour for 1916 was less than 5 cents for lighting and $3\frac{1}{2}$ cents for power. These figures cover everything, including administration, expenses, salaries, and ample amortization for machinery, buildings, and installations.

The central stations throughout the country are small and do not differ materially from similar plants in other countries. As there are no waterfalls except at one of two places along the Paraguay River, which forms the western boundary of the country, the motive power is about equally divided between Diesel and steam engines, with a sprinkling of producer gas engines. The Diesel is the most popular and the one likely to be adopted officially if any standardization is arrived at for the country plants. A list of the several plants with their current characteristics is given on page 132.

LIGHTING.

Outside of Montevideo there is little to be said regarding the peculiar conditions of any one locality. All towns with electricity have adopted it for their public lighting systems while private homes and offices are fast turning to it and abandoning the gas or oil lamps which are so common at present. Incandescent lamps have supplanted the arcs, or, in the newer installations, are the only ones that have ever been used. Little attempt has been made to secure artistic or unusual effects either in street, store, or private lighting

and it will be some time before there is a market for anything other than the simplest devices in standard lamps and fixtures.

In Montevideo there are still approximately 2,000 arc lamps, relics of the early system of lighting. These will be replaced by incandescent lamps some time in the future and thus a considerable market will be offered for suitable types. The exact system to be adopted has not been decided upon as yet, as the Administración General is not ready to assume the expense involved. It is a situation with which manufacturers will have to keep in touch through their local representatives.

The lighting of private homes has not progressed far beyond the use of the simple droplight, but there is a decided tendency toward the introduction of high-grade fixtures and glassware by the progressive dealers. They follow largely the practice of Buenos Aires and are guided by developments in that city, so that any manufacturer wishing to cover well the market in Montevideo should first, or simultaneously, establish good connections in Buenos Aires.

Stores of the better class have improved their lighting, both of their interiors and their windows, so there is remarkably little advance to be made in this direction, except with the smaller stores that are hard to influence except by constant visits of local agents. The ultimate results to be expected are at least as great as those in any city of similar size, but are not so large that it would pay to try to handle the market by itself.

SIGNS, FIXTURES, ETC.

With one or two exceptions, elaborate electric signs are unknown. Those commonly seen are locally made and consist of square boxes with glass sides or grooved tin letters with lamps fastened inside. High-power lamps attached to the outside of the show windows generally take the place of both signs and window lights. It is likely that a small business could be built up for imported signs constructed according to the specifications of a competent local agent, although the excessive freight and duty charges would greatly restrict the number of firms which could afford them. A better market exists for signs composed of letters which can be knocked down for transportation and which can be used for making any sign desired.

The semi-indirect lighting units have attracted favorable notice, and have been so successfully copied that although there is a growing demand it is likely to be filled entirely by cheaper products made locally or imported from Argentina. The glassware is also made locally, and seems to be entirely satisfactory, except for a very few installations.

Fixtures of some sort are used in most private homes and these range from the elaborate crystal chandeliers, so popular in times gone by, to the more modern brass ones, with or without a considerable amount of ornamentation. There is a small importation from the United States, but most brass fixtures are brought in from Argentina. This is true also of the semi-indirect units, which have been very favorably received. The production of the several shops in Buenos Aires is more than adequate for the demand both in Ar-

gentina and Uruguay, and there is little likelihood that any advance can be made in the face of this local competition. There remains a demand for table lamps with unusual shades and bases, but it will be permanent only for such types as require special skill to make.

This fixture trade is the only instance where the importation of electrical goods is seriously threatened at present, but the general tendency toward an increase in national manufacture is being fostered by Government and private institutions alike, and it may not be very long also before the competition of Argentina will be felt in the trade in heating devices, wire and cable, and other articles. The proximity of Buenos Aires gives a decided advantage to manufacturers located there, in the matter of freights and time required for delivery, which is already being made the most of by those in position to cater to the Montevideo market.

INCANDESCENT LAMPS.

European lamps have held first place in the imports into Uruguay, but to-day the Phillips, which is made in Holland, is losing ground to a well-known American make, owing to the activity of the representative who is pushing them. The lack of small-size, gas-filled bulbs is felt very much, as they have been popularized by the agents of Phillips and are one of the strongest sellers in the line of lamps. American manufacturers have not seen fit to bring out such a lamp, and it is suggested that serious consideration be given to its production, in sizes less than 100 candlepower, for 220-volt circuits, before the European firms have made too great headway in introducing their products. The total number of incandescent lamps installed in Montevideo and suburbs was 442,158 at the end of 1916. A measure of the market may be had from the statistics of the central station which show that during the last seven years the average number of new lamps connected annually was 47,500, the smallest number having been 28,169 in 1916, when no extensions were made and the increase was due solely to the natural growth of the districts then receiving current.

As rapidly as conditions permit public lighting is being changed from arc to incandescent lamps. The equipment as it now stands consists of 1,725 12-ampere arcs, most of which are in the center of the city. A total of 305 incandescent lamps of 600 to 1,000 candlepower each have been installed, 73 of 100 to 400 candlepower, and 6,582 of 10 to 50 candlepower.

HEATING AND COOKING.

While there has been very little sale of heating devices, there is going to be a relatively large demand, owing to the low rates now in effect and the special propaganda of the Government. The climate is sufficiently cold during the winter months to make a small amount of heat in the house or office very desirable; and as there are no central heating plants or furnaces in common use, the electric radiator should prove very popular once it becomes known. A considerable number of heaters of a small focusing reflector type were put on display just previous to the cold season last year, and the dealers expected them to be ready sellers, as they are adjustable and can be

used also to boil water and make toast. They are made in Buenos Aires and are sold for less than similar imported goods. They are not particularly well finished, but this is of comparatively small importance as long as they serve their purpose well.

In the shops of the central station a small number of larger heaters have been made after designs originated by the engineers, and these have the advantage that the raw material was obtained locally and the finished product did not pay the duties and freight. Whether the manufacture will continue to be profitable when conditions have become more nearly normal remains to be seen; but there is a feeling that if the heaters can get a start now they will be able to continue on the market. When considering the effect of this manufacture on importations it should be remembered that price is a great factor, and that, other things being equal, the purchasing public is attracted by the cheaper devices.

RANGES—SMALL HEATING DEVICES.

Montevideo will be one of the best South American markets for cooking ranges, due to the extensive cooperation of the central station. In its display room it has installed several kinds of ranges with which it gives frequent practical demonstrations before invited audiences of prospective customers. These ranges are equipped with an apparatus for showing the amount of current used and the cost of operation at the special rates quoted for this business.

A large stock of ranges of each type and size is kept on hand for immediate delivery, and the central station makes a special practice of connecting them, in order to make sure that they are properly installed.

The most popular ranges have four plates but no ovens, these best meeting the conditions of local householders. The heating element is much more liable to damage when exposed and some form of protective covering should be provided, so that the unskilled domestic help available will be prevented from coming in contact with live wires. The voltage is 220, and special care should be taken to provide rugged heating elements. It is found that the breakage in operation on 220-volt ranges is higher than on those of 110 volts, consequently a more liberal free allowance of renewal parts should be allowed.

In order to encourage the use of these ranges the central station in Montevideo charges 4 centesimos (4.14 cents) per kilowatt hour for the first 2,000 consumed and 2 centesimos for each kilowatt hour above that quantity.

Small heating devices, such as irons, toasters, and immersion water heaters, are having a fairly widespread sale and a steady demand for them is being created. Water heaters of sufficient capacity for general household use are being shown by the central stations, and a considerable number have already been sold to the public. The instantaneous type is the most popular, since practically none of the houses are equipped with a hot-water storage tank. The central station, however, has made arrangements for the installation of tanks locally in case the customer prefers connection with a water heater of the continuous-operation type.

The price charged for current for lighting purposes is the same that the customer would pay for heating devices attached to the lamp socket, varying from 12.4 cents to 18.6 cents per kilowatt hour.

FUELS OTHER THAN ELECTRICITY.

In Montevideo the central station meets with competition from the gas company, which is very active, since, with the general adoption of electricity for lighting purposes, it has been forced to secure a greater heating and cooking business. The price charged for gas for lighting, heating, or power is 9 centisimos (9.306 cents) per cubic meter, \$2.64 per thousand cubic feet.

Both alcohol and kerosene are used extensively for cooking and heating, more in the country districts than in the city. Alcohol sells for 30 cents a quart and kerosene for approximately 13 cents per quart.

Wood suitable for cooking stoves costs approximately \$25 per ton and kindling wood sells for \$7 to \$12 per thousand pieces, according to the quantity. Charcoal is sold by dry measure and costs 40 to 50 cents a bushel.

Coal is not used for domestic purposes, being both scarce and expensive. To take its place attempts have been made to develop the large deposits of peat which occur in various sections of the country, but apparently it is not satisfactory either for domestic or industrial purposes.

POWER AND TRACTION.

It is hardly conceivable that manufacturing will ever be carried on on a large scale since many raw materials are lacking, and the local market is so limited that it is hardly profitable to produce anything other than articles of more common use. On account of the abnormal conditions which have existed for several years, importations have been so restricted that it has been necessary to manufacture a great many devices which were previously imported. The success obtained in this direction has created a desire on the part of manufacturers to continue and a great deal of effort is being put forward to insure the maintenance and growth of the manufacturing industry. The "Union Industrial Uruguaya" is composed of some 300 members, all of whom are engaged in manufacturing. Its purpose is to promote national industries by securing tariff protection and other governmental assistance, as well as by helping manufacturers in their individual problems. One of its more ambitious schemes is that mentioned above, namely, the establishment of a free manufacturing zone, within which raw materials could be imported without paying duty, except in the case of goods consumed in the country. It is thought that this, coupled with reciprocal agreements with neighboring Governments for the interchange of national goods, would draw larger industries to Uruguay, as they would thus be in a favorable location for manufacturing articles needed in Argentina and Brazil, two of the largest markets in South America.

At present there are approximately 1,000 shops or factories in Montevideo and suburbs producing over 100 articles or commodities. Most of these shops are relatively small and many employ only hand labor, although a large number of small electric motors have been

installed, as will be seen from the following table showing the number of motors connected to lines of the central station at various dates:

Date.	Motors.		Horsepower.	
	Number.	Yearly increase.	Number.	Yearly increase.
June 30—				
1912.....	1,888	.....	7,980	.....
1913.....	2,758	870	12,508	4,528
1914.....	3,421	663	15,689	3,181
1915.....	3,741	320	16,800	1,111
1916.....	4,098	357	18,116	1,316

The power circuits are three-phase, 50 cycles, 220 volts. Some interior stations are equipped with 230 volts direct current, but the demand for motors outside the district of Montevideo is very small.

A striking example in the use of electric power has been given manufacturers in Uruguay by the American packing plant, which was erected a few years ago in Montevideo. All electrical material for the use of this and other packing plants was purchased in the United States in accordance with specifications issued by the engineering department of these companies.

As the country is mainly dependent on the live-stock industry, there is very little use for power in the country districts.

The Government is attempting to promote the development of mining. The absence of water power is a drawback to the greater use of electric power in either of these industries.

TRACTION.

In Montevideo there are three street-car systems, two of which are already electrified. The third, known as the *Compañía Tranvía del Norte*, is still operated by mule power. The Government has purchased this line and intends to electrify it and extend it to near-by suburban districts as soon as conditions warrant.

The company known as "*La Transatlántica*," is German, and belongs to the same interests that own the central station in Buenos Aires. It has 160 cars and buys its supplies almost exclusively from German factories.

The *Sociedad Comercial de Montevideo* is an English company, operating approximately 250 cars over an extension of track of 90 miles. All its electrical equipment is of English manufacture, and purchases are made through the London office.

Although there has been some talk of electrifying certain lines of the Central Railroad of Uruguay, an English-owned system, it does not seem probable that anything will be done in the immediate future. Except on a few miles of this road, in the vicinity of Montevideo, the track conditions hardly warrant electrification.

TELEGRAPHS AND TELEPHONES.

Two of the international cable companies have offices in Montevideo, but all purchases are made at their headquarters. The same

is true also of the local cable company, the *Compañía Telegráfica-Telefónica del Plata*, a German-owned company, having its main office in Buenos Aires. This company operates telephone and telegraph lines in Uruguay and Argentina, maintaining a set of cables across the river between these two countries.

The principal telegraph lines are owned by the Government. There are approximately 100 stations and 2,700 miles of line, to which additions are being made year by year. The instruments used are mostly of English make, while much of the rest of the material came from Germany. If American companies wish to secure part of this trade it will be necessary for them to make the same types to which Uruguayans have become accustomed.

There are a number of private telephone companies, the only two of importance being in Montevideo. The larger of these is the *Compañía Telefónica de Montevideo*, an English limited company, with some 8,500 subscribers and 16,000 miles of wire. The instruments operate on local battery, with hand-magneto ringing. The lines are all aerial, but the company is very desirous of remodeling the entire system with some new battery equipment and underground cables.

It is not in a position to undertake this improvement, however, since the Government, following its policy of taking over public utilities, has been contemplating the purchase of the company at an early date. The Government is anxious to have more modern installations and undoubtedly it will take the matter up if it purchases the telephone company, or will authorize the present owners to proceed with the work. In either case there will be a very good opening for American telephone equipment.

The *Sociedad Cooperative Telefónica* is a locally owned telephone company, claiming to have some 3,700 subscribers, although probably two-thirds of this figure would be nearer correct. Its equipment is rather antiquated and the installation is in poor shape, but in view of the proposed Government ownership of the telephone lines, the company does not contemplate any extensive improvement. [A full list of the telephone companies of Uruguay will be found on p. 132.]

All wireless installations are owned by the Government. There are four land stations giving a maximum range of 650 miles, the largest of these being the Cerrito station at Montevideo, which is used to communicate with the interior, with Argentina, and with vessels at sea. There are seven marine stations having a range of 100 to 250 miles, and eight portable military stations with a range of about 200 miles. All these stations are of the Telefunken type, a system made by one of the largest German electrical companies. Several extensions or modifications are contemplated by the Ministry of Marine, which has charge of radiographic work and installations.

MARKET FOR SPECIFIC ARTICLES.

DRY BATTERIES—DOORBELLS.

Dry batteries are used in approximately the same numbers as in any city of the same size as Montevideo, although in the country districts the demand is proportionately greater. They are used for automobile ignition, doorbells, and local telephone operation. There

is no local production and all are imported at present from the United States. In former years there was considerable competition from a Danish cell which apparently gave much better satisfaction than others. The price was approximately equal to that charged for the better grade of American cells. As none has appeared in recent years, it is not known what competition may be expected from them from now on. On account of the time elapsing between shipping date and arrival at destination care should be taken to send only selected batteries to insure their being received in good condition and with a reasonable length of life ahead of them.

Doorbells of the ordinary kind are in constant demand, the iron box being more popular than the wooden box. One way of assisting local dealers is to encourage the purchase of gongs separately, since it is thereby possible to carry a larger assortment with the same capital investment. The competition has been with cheap German bells and it should receive attention as soon as European goods are again on the market, as these articles sell purely on a basis of price.

CARBONS FOR ARC LAMPS.

On account of the large number of arc lamps in use in Montevideo there continues to be a sale for suitable carbons. Some of these have been obtained from a factory in Buenos Aires, but they have not given especially good service and there is therefore a continuous demand for European or American carbons. These should be offered to the Administración General de las Usinas del Estado, Montevideo.

FANS.

Desk and wall fans are becoming more popular yearly. For American fans the competition is with the product of the Marelli Co. of Italy. The 12-inch oscillating desk and wall fans are the ones most used, but considerable interest has been aroused in the 6 or 8 inch fans for individual use. Ceiling fans are used to some extent in stores and restaurants. All fans should be wound for 220-volt, single-phase, 50-cycle circuits.

FARM-LIGHTING SETS.

Several kinds of self-contained farm-lighting sets have been introduced with some success. There are a number of isolated farms through the interior, and as they are now using primitive forms of lighting there is an opportunity for a number of sets of 50 to 100 candlepower lighting capacity. These should be suitable for operation with kerosene on account of the cheaper cost of this fuel. Experience with batteries has shown that it would be more desirable, in general, to omit them, since they are fragile and difficult to maintain in a proper condition with the unskilled help available.

FIXTURES.

The demand for fixtures is confined almost entirely to Montevideo, as the smaller household installations consist of flexible-cord drop-lights. The fixtures most desired are of two or four arms and

rather modest in design. Crystal chandeliers were formerly used, but the more pleasing semi-indirect units have taken their place. A few of the more simple fixtures are made locally and many of the more elaborate ones are imported from Buenos Aires, so that in general the opportunity for American fixtures is comparatively small. Gas and electric combination fixtures are not permitted.

FLASH LIGHTS.

The usual types of pocket lamps are being carried in stock by nearly all electrical and novelty dealers, and are coming into popular use. One of the first things to observe in connection with these devices is the necessity for maintaining a good stock of fresh batteries, and manufacturers should arrange to make frequent small shipments of carefully selected batteries. Much difficulty has already been experienced in pushing these lamps, as it has been impossible to furnish fresh renewal batteries, while many of those carried in stock have spoiled completely before they could be used. Only American makes have thus far appeared on the market, and with proper care it is felt that foreign competition can be kept out entirely.

INDUSTRIAL CONTROL DEVICES.

Although a large number of motors are in use, and more are being continually installed, there is practically no demand for the better class of industrial-controlled motors, particularly of the automatic type. There are no rules of installation which require such devices, consequently motor owners are quite content with the cheaper designs. A few are sold from time to time as renewals, but sales of industrial-control material separate from the motors are extremely limited. Nearly all motors are for operation on 220-volt, three-phase, 50-cycle circuits. Formerly they were wound rotor type with brush-raising devices, even down as low as 3 horsepower. This is peculiarly a European type and requires special rheostat for starting.

The American style of squirrel-cage motor has been adopted more widely during the last few years, and these motors require only a lever switch in the smaller sizes. Some, however, have been provided with star delta winding, which requires a special double-throw switch. It has been possible to obtain these from European sources at very low prices, and the sale is so small that it would not warrant the making up of special designs for this market alone. There are some direct-current circuits in the interior, but motors are seldom connected to them, as the manufacturing industry is centered around Montevideo.

INSULATORS.

For house wiring the same kind of small porcelain knobs as those used in Argentina are employed. Here, the American cleat or split knob is practically unknown. Porcelain tubes with curved end are used to some extent as insulator bushings, but the straight tube is seldom used. Both telephone companies in Montevideo use porcelain knobs for their overhead wires, but as they expect to place these underground in the near future they will not now require knobs in

inspectors vary in their estimation of the quality of the work, but it is only recently that there has been a strong inclination to combat the European influence, which has always been for low-grade material. Simultaneously with the Electrical Engineers' Association in Buenos Aires, the administration of central stations is formulating a set of rules which will eliminate much of the poor material and bad practice with which the public has been afflicted in past years, and representatives of American factories should encourage this move in every way possible, as they would derive many benefits from the adoption and enforcement of these rules.

BRAZIL.

FEATURES OF THE MARKET.

Brazil, the fourth largest country in the world, has approximately 3,300,000 square miles of territory, more than the United States without Alaska and 16 times the area of France. In this vast territory there is a population of only some 25,000,000. As far south as latitude 20° the people are mostly along the coast, but south of that point the country is more developed agriculturally and the population spreads out into the interior.

The contour of the country is such as to make Brazil eventually a highly important market for electrical goods because of the mountains and abundant waterfalls near the coast. The whole eastern section, bordering on the Atlantic Ocean, from a point about 300 miles south of the Equator to a point about 1,800 miles south of this line, is mountainous. There are many narrow valleys between the mountains, mostly along the courses of various rivers, but no great extent of plains. The mountain slopes of this section, which terminate abruptly near the ocean, are covered with a luxuriant growth of tropical vegetation. The other two sections are the central and western. The central section is a high undulating plain some 300 miles wide, crossed here and there by low mountain ranges, and continuing in the south through a region of low hills to a sandy stretch along the southern boundary. The western section is much drier than the other two but has great agricultural possibilities when brought under irrigation. It has never been carefully explored and many regions have not been visited by white men.

MOUNTAINS, RIVERS, AND CLIMATE.

There are four distinct mountain ranges in Brazil: (1) The Andes Mountains; (2) the ranges separating the valleys of the Amazon and Orinoco Rivers and forming the boundary between Venezuela and the Guianas and Brazil; (3) the mountains in the central section, including the central and western parts of most of the States to the northern boundary of Parana; (4) the coast ranges, extending southward from the Sao Francisco River to the southern part of the State of Rio Grande do Sul, where the mountains end somewhat abruptly in the vicinity of Porto Alegre and give place to a rather sandy alluvial plain between Porto Alegre and the coast. These last-named ranges are nearly unbroken, with only a few narrow intervening valleys, and in them is found the source of nearly every river emptying into the Atlantic Ocean.

The river system of Brazil is a remarkable one, reaching most parts of the country. Its principal feature, of course, is the Amazon, which, with its tributaries, furnishes more than 30,000 miles of navigable water. On account of the winds, however, navigation is sometimes difficult during the summer months, or January to March. The depth of the river varies from 90 to 900 feet. There are very

few lakes of importance, the largest being a salt-water lake, Lagoa dos Patos, in the State of Rio Grande do Sul.

Contrary to popular impression, Brazil, taken as a whole, is not a hot country. The altitude largely determines the climate, and, as noted, much of the country is high plain or mountains, so that in parts of the year the temperature is so cool that one is not uncomfortable even with heavy clothing. In the lowlands of the Amazon Valley tropical conditions, of course, prevail the year round, and the coastal strip is warm except in winter in the southern part. In the northernmost part of the Republic the rainy season corresponds to the winter months, June to August, but changes to the summer months as one goes southward. All along the coast the rainfall is heavy, often exceeding 60 inches a season. Going westward, however, it becomes lighter and lighter, and in the interior of the State of Bahia and in southwestern Sao Paulo not more than 7 inches is registered annually.

MANY TRADE CENTERS—IMMIGRATION.

For anyone expecting to build up an export business to Brazil it is highly important to note one difference between this country and Argentina. In the latter country practically the whole territory can be handled from Buenos Aires, which is the social and business center. In Brazil the various sections have little business relation with each other, especially with respect to foreign trade, and each is served by its particular port. Not only are these ports considerable distances apart (it is more than 2,500 miles from Pernambuco to Porto Alegre), but the requirements of the sections they serve vary widely. A company that wishes to do business over all this territory should accordingly arrange for representation in each of the larger cities.

Until checked by the war immigration into Brazil was steady, in late years more largely from Italy than from any other country. Many immigrants come from Portugal, the mother country, and to a lesser extent from Spain and elsewhere in Europe. Most of the Italians have settled in the State of Sao Paulo, and often starting with nothing have won economic independence. Large numbers of Germans have settled in the southern States of Parana, Santa Catharina, and Rio Grande do Sul, and have transformed former pasture lands and forests into well-tilled farms. Immigrants find occupation both in the city and in the country.

Brazil is exceedingly rich in resources. Its agricultural and pastoral industries are becoming steadily more important, and mining, manufacturing, lumbering, etc., are only awaiting capital, transportation, and labor to develop into sources of great national wealth.

REVIEW OF MARKET.

Brazil at present is one of the two largest markets for electrical goods in South America. Argentina has been leading slightly in past years, the imports into both countries being approximately equal, but the extent and character of the resources of Brazil are bound to make of it ultimately a larger consumer than Argentina.

The factor of greatest importance in the future demand for electrical goods is the presence of an unlimited supply of water power,

most of which is located within easy reach of the industrial and business centers, where electric power is required. The topography of this section will permit the building of transmission lines at fairly low cost, so that electric power can be sold at prices much lower than those for power generated either with native or imported coal. The two large stations already in operation and furnishing power to Rio de Janeiro, Sao Paulo, and Bahia, cities of special promise for the development of growing industries, have been very successful and have extensive plans for future expansion. Their success makes them good examples for the smaller plants, many of which are looking forward to a growth which will make them second only to these syndicates.

Keeping pace with the industrial development will come the electrification of steam railroads, the extension of tramway systems and telephone lines, and a growing activity in mining. This will mean a growing demand for electrical machinery and supplies by companies in these industries, and also a greater demand for electrical devices from the people, as their purchasing power, already fairly large in comparison with some South American countries, gradually increases and their familiarity with electrical material in the shops makes them desire a wider use of it in their homes.

Many of these developments are not looked for in the immediate future, but it is not too early to lay the foundation for future business. Competition with European manufacturers has not been as keen as elsewhere, and many American practices have been introduced. American material is well known and has been used to a greater or less extent in practically every central station, where it has universally given satisfaction. By carefully studying this market now, and taking advantage of such opportunities as present themselves from time to time, American manufacturers will be able to maintain their leading position.

IMPORTS OF ELECTRICAL GOODS.

Brazil imports more electrical goods from the United States than from any other country. This is due, in large measure, to the fact that the power companies in Rio de Janeiro, Sao Paulo, Santos, and Bahia use American material almost exclusively. The greatest competition has come from German manufacturers, whose business increased steadily, year by year, until 1914, when the total imports fell off to less than one-half the figure for 1913.

Our strongest lines are transformers, insulated wire, generators, and motors, while England normally leads in cables, and Germany in arc-lamp carbons and incandescent lamps. In the miscellaneous small material such as wiring devices, we are well ahead of all competitors at present and should remain so. Other European countries such as France, Italy, and Switzerland are well represented, and obtain fairly large orders, while Holland has been doing very well in lamps. Japanese wire, lamps, and porcelain insulators have appeared on the market, but not in large quantities as yet. Indications are that this Japanese material will become a factor in Brazilian trade, however, in the near future.

The following table gives the values of imports of electrical goods for 1913 and 1914, by articles and countries of origin (kilo=2.2 pounds; values in United States currency):

Articles and countries of origin.	1913		1914	
	Kilos.	Value.	Kilos.	Value.
Machinery and apparatus for electricity and electric light excepting carbons, dynamos, lamps, motors, and transformers:				
Argentina.....	12,807	\$11,826	7,747	\$5,120
Austria-Hungary.....	22,955	3,752	21,154	3,848
Belgium.....	23,315	11,543	110,130	38,322
Denmark.....	4,834	1,381	4,909	1,619
France.....	204,893	126,837	406,320	128,597
Germany.....	2,012,810	790,753	665,914	283,197
Greece.....	152	34		
Italy.....	166,871	63,160	68,414	20,597
Netherlands.....	591	2,045	98	374
Norway.....	33	40	13,939	3,043
Paraguay.....	2,722	1,321	24	61
Portugal.....	1,772	904	4	19
Spain.....			31	476
Sweden.....	15,881	24,438	4,668	6,211
Switzerland.....	129,292	36,096	102,702	30,859
United Kingdom.....	1,510,106	676,133	938,154	438,149
United States.....	2,943,761	1,599,952	1,044,602	714,833
Uruguay.....	12,226	5,402	4,212	2,335
Other countries.....	203	314	41,233	10,388
Total.....	7,065,224	3,355,931	3,434,315	1,688,048
Electric-light carbons:				
Austria-Hungary.....			390	103
Belgium.....	46	25	120	29
France.....	40,847	4,498	46,027	6,162
Germany.....	136,137	48,030	38,980	13,367
Italy.....			17	29
United Kingdom.....	12,947	4,917	5,374	2,354
United States.....	12,816	5,818	18,646	8,092
Uruguay.....	4,060	583	298	47
Total.....	206,853	63,871	109,852	30,183
Electric dynamos and generators:				
Argentina.....	1,448	758	4,592	1,721
Austria-Hungary.....	407	467		
Belgium.....	35	52	900	317
France.....	75,881	24,742	10,938	2,944
Germany.....	172,315	64,042	104,207	32,167
Italy.....	151	66	4,009	869
Sweden.....	9,660	2,479	82	29
Switzerland.....	31,719	5,696	9,533	2,575
United Kingdom.....	98,508	30,820	14,809	5,942
United States.....	372,018	167,377	238,940	81,105
Uruguay.....	598	378	2,095	934
Total.....	762,740	296,877	390,105	128,603
Electric lamps:				
Argentina.....			268	486
Austria-Hungary.....	16,918	12,941	2,494	3,849
Belgium.....	133	445	49	185
France.....	18,328	17,988	19,563	6,187
Germany.....	97,473	254,975	52,395	104,787
Italy.....	232	395	4,462	4,776
Netherlands.....	16,295	46,299	6,467	19,115
Paraguay.....	5	5		
Spain.....	547	1,221		
Sweden.....	163	483	562	2,625
Switzerland.....	130	145		
United Kingdom.....	12,742	39,354	2,417	6,890
United States.....	64,750	101,554	14,937	33,687
Uruguay.....	785	1,450	239	846
Other countries.....	17	72	10	13
Total.....	228,518	477,327	103,863	183,446
Electric motors:				
Argentina.....	259	158	4,079	864
Austria-Hungary.....	805	848	403	170
Belgium.....	15	99	5,202	1,632

Articles and countries of origin.	1913		1914	
	Kilos.	Value.	Kilos.	Value.
Electric motors—Continued.				
France.....	26,848	\$15,190	12,344	\$4,787
Germany.....	279,411	168,538	188,250	67,200
Italy.....	86,485	30,167	60,062	17,359
Netherlands.....	16	22		
Norway.....	9,202	2,058	29	16
Sweden.....	43,422	12,652	8,293	1,557
Switzerland.....	165,250	58,140	63,865	23,263
United Kingdom.....	210,972	94,611	89,378	41,877
United States.....	463,403	215,166	254,581	103,358
Uruguay.....	3,173	1,332		
Other countries.....			11,355	2,672
Total.....	1,489,261	598,976	697,841	264,755
Electric transformers:				
Belgium.....	5,147	2,992		
France.....	3,534	1,830	3,364	5,623
Germany.....	147,490	50,448	55,118	18,874
Italy.....			84	63
Sweden.....	8,592	2,987	2,449	579
Switzerland.....	15,660	4,300	172	128
United Kingdom.....	38,052	15,536	29,879	10,041
United States.....	796,177	329,887	190,825	87,065
Total.....	1,014,652	407,980	281,891	122,373
Insulators (carthenware, porcelain, glass):				
Argentina.....	3,619	1,084	1,800	246
Austria-Hungary.....	23,727	2,850	10,625	1,225
Belgium.....	25,601	4,694	5,500	908
France.....	22,867	5,324	7,174	1,465
Germany.....	623,407	104,240	244,034	42,950
Italy.....	588	111		
Spain.....	9,404	2,600		
Sweden.....	2	3		
Switzerland.....	1,712	137	15	20
United Kingdom.....	53,177	13,230	35,482	13,453
United States.....	379,316	63,883	202,265	33,542
Uruguay.....	4,504	412	286	27
Total.....	1,147,924	198,568	507,181	93,836
Iron and steel wire (except barbed wire):				
Argentina.....	275,088	15,703	386,851	22,280
Austria-Hungary.....	743	48		
Belgium.....	1,314,368	72,450	298,748	16,759
France.....	85,341	10,484	21,206	3,102
Germany.....	20,474,588	1,116,101	8,129,357	406,664
Netherlands.....			500	132
Paraguay.....	5,908	458	7,330	548
Spain.....	1,000	152	500	86
Sweden.....	7,006	1,119	22,263	2,258
Switzerland.....			19	9
United Kingdom.....	1,332,782	109,505	844,791	67,767
United States.....	2,117,808	145,025	1,094,717	72,901
Uruguay.....	973,934	76,903	562,361	42,013
Total.....	26,588,566	1,547,948	11,368,643	634,519
Uninsulated electric copper wire:				
Argentina.....			67	62
Belgium.....	548	233		
France.....	3,854	2,404		
Germany.....	323,252	129,232	72,004	23,442
Italy.....	51,404	18,708		
United Kingdom.....	8,262	7,249	1,045	443
United States.....	334,850	139,244	53,491	20,414
Total.....	722,170	297,070	126,607	44,361
Insulated electric copper wire:				
Argentina.....			133	120
Austria-Hungary.....			220	121
Belgium.....	1,107	481	2,662	795
France.....	7,872	2,912	416	227
Germany.....	174,365	84,117	90,045	36,416
Italy.....	71,655	17,760	639	439
Switzerland.....			506	126

Articles and countries of origin.	1913		1914	
	Kilos.	Value.	Kilos.	Value.
Insulated electric copper wire—Continued.				
United Kingdom.....	37,052	\$20,553	3,860	\$3,108
United States.....	754,374	308,923	272,942	106,355
Uruguay.....	488	238	456	186
Total.....	1,046,916	434,984	371,879	147,893
Electric cables:				
Argentina.....	3,605	856	318	160
Austria-Hungary.....			11,706	2,905
Belgium.....	1,064	538	1,918	794
France.....	147,585	46,699	35,344	22,220
Germany.....	579,580	167,016	196,283	80,121
Italy.....	99,639	35,724	75,686	24,708
Netherlands.....	199	22		
Paraguay.....	684	92		
Switzerland.....	6,551	1,760	3,052	2,233
United Kingdom.....	1,249,851	409,051	409,821	132,286
United States.....	487,856	162,735	264,528	82,907
Uruguay.....	1,276	493	6,892	1,077
Total.....	2,577,890	824,986	1,005,548	349,441

Detailed figures for later years are not yet available, but the totals for 1915 and 1916 for the various classes of imports given in the preceding table were as follows:

Articles.	1915.		1916.	
	Kilos.	Value.	Kilos.	Value.
Machinery and apparatus for electricity and electric light, not elsewhere specified.....	1,857,576	\$702,427	1,825,346	\$762,246
Electric-light carbons.....	125,376	29,066	105,090	25,490
Electric dynamos and generators.....	116,786	40,201	201,653	56,225
Electric lamps.....	78,846	199,559	109,074	211,041
Electric motors.....	198,734	80,162	285,058	83,557
Electric transformers.....	156,526	69,998	330,703	102,945
Insulators (earthenware, porcelain, glass).....	117,810	33,188	310,116	50,504
Iron and steel wire (except barbed wire).....	11,066,668	750,076	15,057,370	1,213,966
Uninsulated electric copper wire.....	123,014	49,436	47,724	20,398
Insulated electric copper wire.....	502,748	211,922	567,073	240,660
Electric wires or cables, not elsewhere specified.....	895,431	266,689	933,126	303,985

TRADE REPRESENTATION.

Since Brazil is so large the subject of representation presents difficulties. It is impossible to cover the entire country from one point, as a traveler attempting to visit all the cities, or even the most important ones, would hardly be able to make more than two round trips a year. Conditions are very different in different sections and it is difficult for a person stationed in Rio de Janeiro, for example, to keep closely in touch with such remote places as Rio Grande, Pernambuco, and Para. Each of these cities acts as an importing and distributing center for the surrounding territory and it is almost imperative for exporters to have an agent to look after their interests in each one as well as in several others of equal importance.

Whether this representative should be a local branch house or a resident business firm depends largely upon the character of the products to be handled. In any event, it is desirable to have at least one

factory representative to act in the capacity of superintendent of the various agencies and to keep the home office posted regarding the numerous details that must be looked after. This man should be able to act on behalf of the company in matters calling for immediate decisions, to settle disputes, and to deal with the Government and municipalities. The last-named function is particularly important where contracts for materials are to be filled.

The electrical business is carried on mainly by houses handling general lines of machinery, perhaps with a separate electrical department. These houses sometimes handle certain lines of goods on an exclusive basis and sometimes buy in the open market from the company which gives them the lowest price or in other ways seems most satisfactory to them. There are also a number of houses dealing exclusively in electrical material. The central station does not form new connections as an importer, the best results apparently having been obtained by the establishment of factory branches. This has been done by Italian and German companies, and at least by one American company. Smaller concerns unable to do this should try to unite in maintaining a small organization. If this should be done, and the several manufacturers should cater in every practicable manner to local requirements, their business would undoubtedly grow.

CREDITS AND FINANCES.

Accustomed as the local dealers were to receiving long credits from European houses, it was difficult for them, when the war broke out, to accustom themselves to paying cash in advance or even cash against documents. Insistence on these terms by so many American exporters caused considerable friction and may have lasting results. At any rate local dealers are now obviously awaiting the return of commercial travelers representing European houses.

Evidently there has been a decided tendency of late toward greater leniency in the matter of credit. There would seem to be no good reason why, with due diligence in selecting agents, the American manufacturer should not be able to adopt the practice of sending a 90-day draft with his goods, which in almost every case would be entirely satisfactory to his customers. American banks have been established and are now operating in several of the chief cities and are in a position to furnish credit information, handle documents, and do all other legitimate business for the assistance of American houses. The unusually long terms often spoken of were given only on rare occasions, and then by organizations with local branches, or by business houses in the territory concerned. The object was either to eliminate competition or to bind the client more closely. In either case, the practice is a questionable one, and certainly should not be followed blindly. As a matter of fact, few people require or want unduly long terms of credit, but a certain length of time, usually three months, is desired, for the many reasons for which credit is desired in any business. The present situation should be watched carefully in order that promises of long or apparently extra favorable terms are not made the instruments for taking away customers now satisfied with their business connections. Free use should be made of banks, agents, and other reliable sources of information in keeping in touch with changing conditions, and if this is done there is little

danger of losing customers to competitors who offer better terms, or of losing money from bad accounts.

FORMS OF ADVERTISING.

All the familiar forms of advertising are used in Brazil, although on a scale considerably smaller than that to which we are accustomed.

Billboards and electrical signs are quite common, and the various newspapers and weekly magazines are filled with announcements of all kinds. Each of these methods is desirable for its own particular field, and in addition good use can be made of envelope stuffers, bulletins for free distribution, window displays, and colored stickers. One plan which has been followed with considerable success, consists in furnishing dealers with business paper and envelopes, showing conspicuously the name and product of the manufacturer. Trade papers published in English are a very good medium for reaching the central stations and engineers, and the export trade journals are valuable in reaching the dealers and import agents.

With some electrical devices advertising produces better results than with others, and manufacturers should study the problem carefully from their individual standpoints. It is generally true that more advertising should be done, and the manufacturer could well afford to be liberal in making allowances to his local representatives for carrying on their publicity programs. These allowances might be either in the form of actual cash or of cuts and other prepared matter ready for insertion in the newspapers or magazines. All bulletins, catalogues, and similar material should, of course, be furnished free of charge.

ADVERTISING LAMPS.

Lamps should be advertised particularly for the consumer, and for this purpose, billboards or electric signs, if placed at well-chosen points, will undoubtedly be of great value. Constant appearance in the local newspapers and magazines of well presented and attractive announcements is indispensable. Street-car cards are widely used and are probably equally as productive of results as in other countries. Window displays should be arranged at every opportunity, as the incandescent lamp lends itself well to novel arrangements that are sure to attract attention.

Fan motors and heating and cooking devices must also be advertised to the consumer, and the foregoing suggestions apply also to them. In addition, the dealers or central stations handling the goods should be encouraged to give practical demonstrations to their customers individually, and to have public demonstrations at frequent intervals. Many of these devices are very little known and it is only by such demonstrations that the public can be made acquainted with them so that they may become a part of the every-day life of people generally, rather than a novelty or luxury to be enjoyed only by a few of the more progressive.

ADVERTISING BATTERIES, ETC.

Dry batteries, switches, wire and wiring devices, while purchased largely by individuals, are handled in the main by contractors and

wiremen, and the only practical way to reach them is through the retail dealers. There seems, therefore, to be little advantage in advertising these lines in the manner described above. The surest way of establishing them firmly in the market is to appoint an agent or representative and make him so familiar with the line, its qualities and possibilities, that he will pass his enthusiasm along to the dealer, so that the latter will put forward the American goods in preference to others when no specific type is requested by the purchaser. This should be supplemented by envelope stuffers, inserted leaflets, detailed catalogues, and sample boards. In addition to this, if every precaution is taken to treat the agent and dealer squarely and the goods and prices are satisfactory, a great deal can be done toward educating the contractor, wiremen, and even the general public to specify these particular goods by name.

Other articles, such as motors, station equipment, and railroad material, can be made the subject of public announcements, but the result would hardly justify any great expenditure. Nearly all users of such material have access to trade papers or export journals and therefore see announcements, whether they have been intended particularly for foreign trade or not. It is not to be expected that all buyers will be reached by the use of magazines, but rather they will supplement the personal efforts of the local representatives, who are constantly canvassing the field and coming into personal contact with possible buyers.

USE OF PORTUGUESE LANGUAGE.

Printed matter intended for agents or others known to speak English may be in that language, but for general purposes all catalogues, leaflets, envelope stuffers, inserts, articles, and correspondence intended for Brazil must be in Portuguese, not Spanish. This point is still not generally appreciated, and it was recently necessary for a branch house in Rio de Janeiro to write emphatically to the parent company: "It should not go on record as an accepted theory that publications in Spanish will answer equally well for Portuguese." The theory so prevalent in the United States that one language is only a corruption of the other is not only incorrect, but fails to take into consideration the fact that the Brazilian is as proud of the language and literature which he has inherited as his neighbors are of theirs, and if we hope to found permanent business relations with a nation of 25,000,000 people we must address them in their own language.

Further and more detailed information regarding the use of advertising in Brazil is being prepared for publication in a monograph to be issued by the Bureau of Foreign and Domestic Commerce.

PACKING.

So much has already been written regarding packing that little need be said on this point, other than that the usual precautions should be taken to see that machinery and heavy apparatus is securely bolted and braced within the cases. The greatest trouble seems to have been experienced with the packing which permitted the contents of boxes to break loose, either damaging themselves

or by destroying the packing, exposing themselves to the weather and rough treatment.

Lamps and other fragile articles should be incased in lightweight but tough packages and either floated in excelsior or other resilient material, or otherwise protected against jars. Packing cases made of tough cardboard or similar fibrous material have been used to very good advantage.

Where the import tariff is based on the gross weight of the package, with or without tare, each manufacturer should weigh his packed product, and keep this weight the minimum consistent with strength. In every case it is desirable that he obtain from his agents any suggestions they may wish to make based upon their experience and also that he learn from them the condition in which the goods are received. Their advice often leads to modifications which can be made with little or no expense but which save much time and annoyance.

ENGINEERING SCHOOLS.

The Brazilian system of higher education has devoted much more attention to literature, medicine, and law than to engineering; but it is possible to obtain competent instruction in the last-named subject, especially in civil and mining engineering. The School of Mines at Ouro Preto, in the State of Minas Geraes, is perhaps one of the best equipped in South America, especially with laboratory apparatus.

In Porto Alegre, in the State of Rio Grande do Sul, the engineering school (Escola de Engenharia), makes a special feature of its electrical course. It has machine shops and testing rooms fitted up with the latest types of modern machinery, where the students become familiar both in theory and in practice with their operation and design. This machinery was mounted by and for some time remained under the supervision of an engineer brought from the United States for this purpose. Members of the teaching staff have received part of their education in the United States, and as a consequence, the students are made familiar with American machinery and practices and are certain to remain favorably disposed toward our products during their future years of active work.

A polytechnical school (Escola Polytechnica) in Rio de Janeiro is the principal engineering school in the Republic. Its facilities include laboratories and classrooms for teaching all branches of engineering, and it has turned out some very capable engineers. Manufacturers in a position to do so would do well to keep in touch with these various schools and arrange means of displaying their products to the student body, either by sending actual manufactures or through catalogues. These students may later become purchasers, or may be in a position to influence the decision regarding types of material to be used in some of the large projects which will be carried out from time to time in the future.

The principal engineering society is the Club de Engenharia of Rio de Janeiro. Its members are elected from all branches of the engineering profession, and although electrical engineers are in the minority, practically every member is familiar with or interested in such subjects as hydroelectric development and mine or railway

electrification. Its bulletin is the only magazine devoted strictly to engineering subjects, and in it appear not only the proceedings of the society, but contributed articles concerning topics of general interest to the club.

HYDROELECTRIC DEVELOPMENTS.

Water power is abundant in the States of Parana, Sao Paulo, Rio de Janeiro, Minas Geraes, and a part of Santa Catharina. Fortunately, this section of the country is most suitable for industrial development, owing to its climate and natural resources. With the presence of continuous waterfalls, power will be available in indefinite amounts and at relatively low rates, thus relieving the otherwise difficult situation with respect to fuel. Native coal is now being mined in considerable quantities, but it is of inferior quality, and imported coal is very much preferred. Up to 1914 imported coal was practically the only kind available, but with the increasing cost the use of the domestic product became more profitable. The choice, in fact, lay between domestic coal or wood, since the exportation of coal from England and the United States was practically suspended. The present price of English coal is approximately \$30 per ton in Rio de Janeiro, and wood, although abundant, is rather inefficient as fuel; the way is open, therefore, for a much wider development of the water power with which Brazil is so well supplied in exactly the location where it is most needed.

The first large water-power plant was erected in 1901 at the falls of Parnahyba on the River Tiete, with a capacity of 8,000 horsepower, which was transmitted 21 miles to the city of Sao Paulo. Since then several large installations have been put in, among which may be mentioned the 90,000-horsepower plant of Riberao dos Lages, from which power is transmitted at 88,000 volts to Rio de Janeiro, and the plant of the Cia. Docas de Santos on the Itatinga River, with a capacity of 20,000 horsepower, which is transmitted 20 miles to the city of Santos.

LARGE WATERFALLS.

The number of large waterfalls—that is, those with a capacity of 50,000 horsepower or more—is surprising. Following is a list of the principal ones, with the estimated power available:

	Horsepower.		Horsepower.
Bracuhy_____	50, 000	Douradas_____	400, 000
Ihla dos Pombos_____	50, 000	Urubu-punga_____	450, 000
Itakura_____	50, 000	Herval_____	750, 000
Avanhandava_____	60, 000	Patos and Maribondo_____	800, 000
Itapanahart_____	80, 000	Paulo Affonso_____	1, 500, 000
Onca_____	220, 000	Iguazu_____	3, 000, 000
Agua Vermelha_____	300, 000	Sete Quedas_____	20, 000, 000

Many of these falls, especially the largest two, are located so far from any industrial center that their development is highly impracticable at the moment. The possibilities are so tempting, however, that various studies have been made with a view to finding out how the power could be turned into productive channels. Almost invariably the conclusion of these studies has been that the only satisfactory solution of the problem would be the establishment of industries requiring a large amount of power in the immediate neighbor-

hood of the falls themselves. Two industries have been considered, namely, the production of iron and steel and the production of chemicals, such as the extraction of nitrate from the air. The quantity of apparatus and equipment which either of these projects would call for can only be imagined. That it is feasible to develop the chemical industry is apparent from the fact that a plant producing calcium chloride has been in operation for some time, and one or more plants for the production of caustic soda are to be erected in the near future. If they succeed they will give an impulse to the erection of other establishments, all of which will mean an increased market for electrical machinery.

In addition to the above-mentioned waterfalls, there are a great number having between 6,000 and 50,000 horsepower, while those with less than 6,000 horsepower are practically numberless.

In the State of Parana there are known to exist some 100 fairly large waterfalls, with a total capacity estimated at approximately 1,500,000 horsepower. In this State, also, are located the various cataracts of the Igauzu and Sete Quedas. Minas Geraes has more small waterfalls than any other State, and the local government recognizes the important part which they are destined to play in the future economic life of that State.

At least 1,100 falls of varying sizes have been reported and rough surveys of 420 of these resulted in an estimated capacity of 2,500,000 horsepower. This figure is not to be considered as accurate, but it serves as an indication of the tremendous amount of power which really is available. Much of it is within the reach of towns needing it for light and power, and the surrounding country is topographically favorable for comparatively easy development. The rainfall is fairly uniform, so the streams maintain a reasonably constant flow, and the construction of storage ponds is not difficult. Probably the greatest development will be on streams furnishing a low or moderate head, although in the Coastal Range unusually high heads are found, as on the Itatinga River, where the difference in level between the intake and the turbines on the plant of the Cia. Brasileira de Energia Electrica, which furnishes power to the city and docks of Santos, is 640 meters (2,100 feet).

While a majority of the waterfalls are located in the southern section of the country, there are several in other sections, and all of them have been under consideration as a probable source of industrial power. Estimates place the total waterpower available in Brazil at 30,000,000 to 50,000,000 horsepower.

The laws relating to the development of hydraulic resources are inadequate, and neither encourage in a broad way the installation of large plants, nor define completely the protection which will be given to concessionaires. The State Governments and the Federal Government realize this fact, and for some time have been attempting to evolve constructive legislation to cover all requirements. When they shall have succeeded, the country as a whole will be greatly benefited.

CENTRAL STATIONS AND TRANSMISSION LINES.

Electric-lighting plants were being extensively established in Brazil up to 1914, and even during the last four years considerable progress has been made. The people appreciate the value and importance of

electricity in its various uses, and several European and American manufacturers with permanent representation in Rio de Janeiro are continuously active in their propaganda for new installations. Many of the smaller plants have been put in with the assistance of European capital. It was a common practice for engineers representing electrical firms to submit original proposals to the various municipalities and to handle all details, including the final erection of the machines. This procedure was very successful in obtaining for them a satisfactory volume of business, and, of course, it assured them continuous business in supplies and extensions. There is still a very considerable field which could be covered in the same manner.

Owing to the influence of capital when orders for machinery and general material are placed, it would be profitable to form a combination of smaller central stations in certain localities, and operate them as a unit. Manufacturers investing in such a combination would secure the double benefit of a market for their machinery and profit from the operation of the plants. The proposition was investigated by American interests a few years ago, but the matter was dropped; since then local capitalists have taken up the idea and purchased several of the plants, thus eliminating them from the market.

TWO LARGE COMPANIES.

Two large companies are operating at present, and both use almost exclusively American machinery and materials. The larger of these, the Brazilian Traction Light & Power Co. (Ltd.), is a Canadian corporation, owning the three plants which furnish power to Rio de Janeiro, Sao Paulo, and neighboring towns. The company in Rio de Janeiro is the Rio de Janeiro Tramway Light & Power Co. (Ltd.) and the two in Sao Paulo are the Sao Paulo Tramway Light & Power Co. (Ltd.) and the Sao Paulo Electric Co. (Ltd.). The management and general offices of all three are in Rio de Janeiro. Purchases in the United States are made through the Pierson Engineering Corporation, 115 Broadway, New York, but only upon requests from and recommendation of the resident engineer in Rio de Janeiro.

The second company referred to is the Cia. Brasileira de Energia Electrica. Its activities consist in the construction and operation of generating stations to furnish power in the States of Bahia, Rio de Janeiro, and Sao Paulo, as well as in the Federal District. It was founded in 1909 with Brazilian capital, to exploit concessions obtained by Guinle & Co., and is managed by the latter interests. Its main office is at Avenida Rio Branco 107, Rio de Janeiro, through which all purchases are made. Correspondence with this company may be in English.

RIO DE JANEIRO TRAMWAY LIGHT & POWER CO.

The hydroelectric generating plant of the Rio de Janeiro Tramway Light & Power Co. is located on the Lages River (Riberão das Lages), where an extensive reservoir system has been installed. The present equipment consists of two 10,000-kilowatt alternators and six with 4,000 kilowatts capacity each. From the generator voltage of 6,000 the current is stepped up to 88,000 volts for transmission

over multiple circuits to Rio de Janeiro, a distance of 81 kilometers (50 miles). Two transformer substations, one located in the center of the city and the other near the outskirts, having a combined transformer capacity of 35,000 kilovolt amperes, reduce the voltage to 2,400 and to 6,000 volts for distribution to the various substations throughout the district.

A part of this power is converted into direct current at 575 volts for the street railways, while the rest is distributed among light and power customers on a three-phase, four-wire basis. The potential between phases is 216.5 volts and between neutral and any phase is 125 volts, the latter being used for light, and the former for power.

A reserve steam plant having four 2,500-kilovolt-ampere and two 5,000-kilovolt-ampere turbogenerators is maintained for use in times of low water or other emergencies.

SÃO PAULO COMPANIES.

The Sao Paulo Tramway Light & Power Co. furnishes light and power to Sao Paulo, Santo Amaro, and other smaller municipalities. It also operates the trolley systems in Sao Paulo and Santo Amaro. Its hydroelectric power plant is located on the Tieté River, near Parnahyba; the generating equipment consists of eight 2,000-kilowatt, three-phase 50-cycle generators. The power is transmitted at a potential of 40,000 volts for a distance of 24 kilometers (15 miles), there being four independent three-phase circuits between the generating plant and the substation at Sao Paulo.

In addition to power furnished by its own plant, this company purchases large amounts from the Sao Paulo Electric Co. Power from the latter plant is transmitted a distance of 80 kilometers (49.6 miles) over duplicate three-phase 88,000-volt transmission lines.

The Sao Paulo Electric Co. (Ltd.) is a subsidiary of the Brazilian Traction Light & Power Co. (Ltd.) and operates in the State of Sao Paulo. Its principal customers are the Sao Paulo Tramway Light & Power Co. (Ltd.) and the municipalities of Sorocaba and Sao Roque. Power is generated at the hydroelectric station on the Sorocaba River, 10 kilometers (6.2 miles) from Sorocaba and 80 kilometers from Sao Paulo. The present capacity is 30,000 kilowatts, which can be increased to 50,000 at some future date.

A duplicate transmission line with a potential of 88,000 volts conveys the current to Sao Paulo, and 15,000-volt circuits feed the towns of Sorocaba and Sao Roque, distant, respectively, 10 and 35 kilometers (6.2 and 21.7 miles) from the power house. All electrical machinery is of American manufacture.

THE BRASILEIRA DE ENERGIA ELECTRICA.

The principal plant of the Cia. Brasileira de Energia Electrica is located at Alberto Torres on the Piabanha River, and has a present capacity of 15,000 kilowatts. The current is transmitted to the cities of Niteroy and Rio de Janeiro, as well as several intermediate points. This company owns also the rights to develop other falls in the immediate neighborhood of this plant, the combined capacity ag-

gregating over 70,000 horsepower. In view of the very rapid increase in the use of power, it is expected that extensions to the existing equipment will be required in the near future, and plans are being formulated for the erection of a new plant which will be required before very long.

The city and docks of Bahia and the cities of Sao Felix and Santo Amaro receive light and power from a station on the Paraguassu River. Three falls on this river aggregating 100,000 horsepower are owned by this company, and a new plant is being constructed.

To furnish power to its affiliated company, the Cia. Docas de Santos, the Cia. Brasileira de Energia Electrica has a generating plant on the Itatinga River, from which current is transmitted to the city of Santos. The light and power are handled by an English company, known as the City of Santos Improvement Co., while extensive docks are administered by the Cia. Docas de Santos.

All the equipment in use or under consideration by the Cia. Brasileira de Energia Electrica is of American manufacture, with the single exception of the water wheels, which as elsewhere in Brazil are practically all of European makê. The circuits are three-phase, 60-cycle, 220 volts for light and 440 volts for power.

CENTRAL STATIONS AT PORTO ALEGRE.

There are three central stations in Porto Alegre, one belonging to the municipality, one to the Cia. Fiat Lux, and the other to the Cia. de Forca e Luz Porto Alegrense.

The municipal plant furnishes current for the public lighting, and for private lighting in the outskirts and suburbs of the city. Its equipment consists of one De Laval steam turbine geared to two French dynamos of 125 kilowatts each, and two 100-kilowatt generators driven by horizontal engines. All switchboards are of French make.

The plant of the Fiat Lux furnishes current for general purposes throughout the city. Its equipment consists of nine generators of various types and sizes, and one modern steam-turbine set, consisting of a turbine driving two Siemens-Schuckert generators of 350 kilowatts capacity each. Space has been prepared for a second double turbine outfit, which the company intends to install in the near future.

The most important plant is that of the Cia. de Forca e Luz. It has a total capacity of 2,650 kilowatts, all machines having Dick-Kerr generators, driven by Bellis and Morcom engines. Current is used for general lighting and power purposes, and for operating the street-railway system, which is owned by this company.

PELOTAS—RIO GRANDE—BELLO HORIZONTE.

The Rio Grandense Light & Power Syndicate (Ltd.) is financed by local and British capital in about equal proportions, and is operated by the British Electric Traction Co. Its plant has a capacity of 1,000 kilowatts in direct-current generators. All the current is used for power and lighting by the street-railway system which the company owns. The company requires a rather higher grade of

construction work for connection to its circuits than is customarily found in smaller localities, and nearly all its equipment is of British manufacture. Purchases are made largely direct from England or through Brazilian and Argentine houses.

The French company which has the contract for improving the port of Rio Grande is known as the Cie. Francaise du Port de Rio Grande. It owns two central stations located in that city. The old plant has American machinery with a capacity of 300 kilowatts, the current being used for lighting and power throughout the city. The new plant generates 800 kilowatts, mostly in 550 volts, direct-current, for the city tramway and the freight-handling equipment of the port.

The State of Minas Geraes owns the central station at Bello Horizonte, and rents it to the Cia. de Electricidade y Viacão Urbano. The equipment is all American made and the company is largely committed to the principle of using no other types.

PERNAMBUCO—PARA—JUIZ DE FORA.

The Pernambuco Tramway, Light & Power Co. (Ltd.) is an English company, and has a well-equipped steam plant, which furnishes the current for the tramways as well as for general lighting and power purposes. It is studying the possibility of bringing current from water power located approximately 50 miles from Pernambuco, but no definite conclusions have been reached as yet. This company is in a very prosperous condition, and may be forced to expand its equipment materially in the near future.

The Para Electric Railway & Lighting Co. (Ltd.) is an English company with a steam plant on the outskirts of the city of Para. All the machinery is of English make, and the company is committed more or less to the exclusive purchase of English material, although it has used many articles of American manufacture which have proved quite satisfactory. It is in a position to expand considerably, and American manufacturers should keep in touch with it.

In view of the British ownership of the central stations in Pernambuco, Ceara, Para, and Manaos, it is expected that their purchases will be confined very largely to British material.

One of the oldest electrical companies in Brazil is the Cia. Mineira de Electricidade, in the city of Juiz de Fora. It was founded in 1888, and since then has been remodeled and brought up to date in every particular. It is now installing new machinery, which will give it a capacity of 6,800 kilowatts. All the machinery is of American manufacture, and it is expected that this will continue to be the case in the future.

TRANSMISSION LINES.

Brazil is preeminently a country suitable for the development of transmission lines. The waterfalls are very abundant in the southern section of the country, and numbers of them have been developed up to the present time, while many more are being studied, and will be harnessed as time goes on. The larger falls are seldom found in the immediate vicinity of the consuming centers, and consequently it is necessary to transmit power from greater or smaller distances. The longest transmission line is owned by the Cia. Brasileira de

Energia Electrica, and furnishes power generated at its plant on the Bananeiras Falls of the Paragassú River to the city of Bahia. Current is furnished, also, to the cities of Cachoeira, Sao Felix, and Santo Amaro.

The line of highest voltage is that of the Rio de Janeiro Tramway, Light & Power Co. From its plant on the Riberao das Lages, where the current is generated for the city of Rio, it is transmitted 30 miles, at a tension of 88,000 volts.

The Sao Paulo Tramway, Light & Power Co. and the Sao Paulo Electric Co. have stations in the State of Sao Paulo, and have a total of some 50 miles of transmission lines of 44,000 volts. They also have a number of lines of 24,000 volts connecting their circuits with some smaller towns in the neighborhood of Sao Paulo, Jundiahy, and Sorocaba.

The Cia. Docas de Santos receives current from the Itatinga plant of the Cia. Brasileira de Energia Electrica. This plant is 20 miles from Santos, to which the power is transmitted at a tension of 45,000 volts. The latter company is also the owner of the Alberto Torres plant on the Piabanha River, from which power is transmitted at a tension of 45,000 volts, a distance of 18 miles, to a switching station at Cascatinha. From this point double lines are run to the city of Rio de Janeiro, and also to Nictheroy, a distance of 37 miles each.

Some of the other transmission lines of interest are the following:

Location.	Company.	Capacity.	Distance.	Voltage.
		<i>Kilowatts.</i>	<i>Miles.</i>	
Bello Horizonte.....	Cia. de Electricidade e Viacao Urbano.....	1,800	25	45,000
Cataguazes.....	Cia. Força e Luz Leopoldina.....	1,000	53	22,000
Juiz de Fora.....	Cia. Mineira de Electricidade.....	1,200	3	4,000
Lavras.....	Cia. Força e Luz Lavras.....	240	14	10,500
Oliveira.....	Cia. Luz e Força Oliveira.....	200	11	10,500
Morro Velho.....	St. John del Rey Mining Co.....	3,000	14	15,000
Pocos De Caldos.....	Cia. Luz Electrica.....	250	29	25,000
Pouso Alegre.....	Cia. Força e Luz.....	100	19	15,000
Santa Barbara.....	Cia. de Mineiro San Bento.....	600	8	8,000
Sao Joao del Rei.....	Cia. Luz Electrica.....	1,500	7	8,000
Uberaba.....	.....do.....	300	.....	11,000

All the foregoing transmission lines make use of steel and iron poles of various types and sizes, in accordance with individual requirements. Much of the material is of American manufacture. On account of the expansion of plants already established, as well as the installation of new plants, the market for this grade of material is one of growing importance.

LIGHTING, HEATING, AND COOKING.

STORE LIGHTING.

In all the better-class stores modern fixtures and reflectors are being installed. The indirect system is being adopted in many instances, and has already attained such proportions as to warrant a belief that it will replace all other forms in the future. No one type appears to have a greater demand than another, but the cheaper forms consisting of bowl and reflector of opal glass, attached in a simple manner to the socket, are taking very readily.

In the smaller stores, drop-lights, with, or more usually without, glass reflectors of various designs seem to be entirely satisfactory, as the cost is comparatively low. The reflectors employed were formerly mostly of American design, but recent European imitations have appeared and have been able to undersell to such an extent that they have been gradually replacing the better article. In two or three of the larger cities, an active representative with one or more types of efficient reflector or combined unit would be able to obtain a very substantial amount of business. In the smaller towns, and particularly in the interior, little improvement is to be expected along this line for a long time.

WINDOW LIGHTING.

Some small progress has been made in the introduction of special window-lighting fixtures; for example, colored lights and blue-glass bulbs have been installed in a few instances, but in general window lighting is far behind that to which we are accustomed.

The field for the better class of material for this purpose is confined to Rio de Janeiro, Sao Paulo, Santos, and one or two other cities, as a great majority of the storekeepers are quite content with the present installation, consisting usually of two drop-lights with high-power lamps, without a shade or reflector, suspended in the center of the window. The effect is such an improvement over that possible with gas or kerosene lighting that they see little use in attempting further improvement. Time and education are the two principal factors which will modify this attitude.

The window-lighting outfit most likely to be popular would be a cheap form of metal reflector to contain one or more lamps, which would be placed at the sides or top of the window. In this way the transition from crude to modern methods would not be abrupt. Any system based upon an accurate calculation of illumination would hardly be satisfactory, owing largely to the lack of ability on the part of local agents to make such calculations.

SIGN LIGHTING.

In Sao Paulo and Rio de Janeiro, but especially in the former, modern electric signs are more common than in any other cities. These, instead of being the usual crude homemade affairs, are almost all imported, and apparently are made to order rather than formed of stock parts. The situation here affords a good illustration of what can be done by a progressive central station in the face of great apparent odds. In general, it would seem difficult if not impossible, to build up any trade in electric signs, which on account of their bulk and weight have to bear heavy freight and import charges, in addition to their high initial cost. In Sao Paulo special arrangements, such as terms of payment in the form of rent, were made, with the result that some very attractive signs have been erected. Without similar action on the part of other central stations, it will be difficult to obtain any business in other cities, as some such inducement must be offered in order to interest the prospective customer. The value of attractive electrical advertising is just beginning to be felt, and there is still need for much personal propaganda in demonstrating its possibilities.

PUBLIC LIGHTING.

In all cities having gas plants, street and park lighting has always been done either by open flame or, more recently, by incandescent mantle gas lamps. The movement toward replacing these with electric lamps has been quite general in the last two or three years, aided in some instances by the fact that the scarcity of fuel made it imperative to reduce the gas production to a minimum. In Porto Alegre, for instance, temporary electric lights were installed by attaching ordinary sockets to a wooden base, which could be mounted within the gas lantern. Connections were made to the overhead lighting circuits through a pair of No. 12 rubber-covered wires through a fuse and snap switch mounted on the lamp bowl. This was purely a temporary and emergency job, and it is expected that suitable fixtures will be purchased by the municipality and that gaslight will be abandoned in the near future.

In the city of Rio de Janeiro there are some 22,000 gaslights, all with incandescent lanterns, and mounted on semiornamental standards with one or three lights. For the main lighting system, however, dependence is placed upon arc lamps, of which more than 8,000 are now in use. These operate on series circuits, fed by constant-current transformers. A much smaller number of arclamps is used in Sao Paulo and Santos, and here, as in all other cities and towns, the tendency is toward the installation of incandescent lamps to replace all other forms of street lighting. The larger installations probably will retain their series circuits, while the smaller ones will be of the multiple type. Thus while the market for arc lamps and arc-lamp carbons is at its maximum, the demand for incandescent lighting fixtures may be said to be just beginning.

LAMPS.

European types of incandescent lamps, such as the Osram and the Phillips, have been very popular, and threatened to flood the market at the outbreak of the war. Later, American lamps have been sold in large quantities, and with improvements which have been made in the system of distribution, it is probable that they will hold their own indefinitely. These European lamps are of good quality, while the fact that the manufacturers developed the small gas-filled lamps to a higher degree than have the American manufacturers gives them a decided advantage, since this type has become much more popular than the ordinary tungsten-filament lamp.

Two popular voltages for which lamps must be designed are 125 for the city of Rio de Janeiro and 220 for nearly all the rest of the cities. The smaller sizes are most in demand, of course, but for advertising and street lighting units as high as 1,000 watts are not at all uncommon.

An Edison screw base is the only one in popular use, the bayonet socket being confined to the special low-voltage lamps for train lighting. Carbon-filament lamps are still sold but only in insignificant quantities, and they can hardly be said to be a factor in the lamp trade. The same may be said of the miniature bulbs or the various shapes different from the standard pear and round bulb.

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In the smaller stores, drop-lights, with, or more usually without, glass reflectors of various designs seem to be entirely satisfactory, as the cost is comparatively low. The reflectors employed were formerly mostly of American design, but recent European imitations have appeared and have been able to undersell to such an extent that they have been gradually replacing the better article. In two or three of the larger cities, an active representative with one or more types of efficient reflector or combined unit would be able to obtain a very substantial amount of business. In the smaller towns, and particularly in the interior, little improvement is to be expected along this line for a long time.

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Arc lamps have reached their point of maximum demand and there seems to be no reason to expect an increase in, or even a con-

tinuation of, their sale, except for replacements or renewals for installations already in operation.

Taking advantage of the policy of the Brazilian Government to foster local production it might be very profitable to establish a factory for making the most salable kinds of incandescent lamps. Labor is fairly abundant and could be trained quite easily to operate the necessary machinery, so it is largely a question of whether the raw material could be produced locally or imported at a sufficiently low rate to more than offset the higher cost of production in such a factory compared with that in an establishment turning out lamps in a much greater quantity. Factories established at some convenient point with cheap power should be able to compete successfully for the Argentine market, which, combined with the Brazilian market, offers a very considerable field. Importations of incandescent lamps into Brazil and Argentina in 1913 amounted to over \$400,000, and while a national lamp undoubtedly would suffer at first, merely from the fact that the consumer would not believe that it could possibly be as good as an imported lamp, this feeling could be overcome by a properly directed advertising campaign.

HEATING AND COOKING.

The advantages of electricity for heating and cooking are but little appreciated as yet. With the tremendous resources in water power, it seems improbable that this situation can exist very long, although there are some factors unfavorable to a change. For example, the climate of almost the entire coastal section is tropical, and the temperature at certain times of the year becomes uncomfortably warm. Heating devices for this section of the country are quite unnecessary. The field for these articles would probably be confined to the cities in the southern and central plateau, where the temperature, owing to the altitude, is often too low for full comfort. Small resistance-type heaters have been introduced into the market, and according to reports, are being received with some favor, considering the fact that formerly it was never customary to furnish heat in any form, and that it is only in recent years that oil stoves and small wood-burning stoves have been taken up by the general public. It is too early to expect much of a demand for the electric heater, which is so far in advance of the local habits and customs. A drawback especially common in the homes, is the fact that the wiring is not of sufficient capacity to permit the use of current-consuming devices. However this is not an important difficulty. The fact that the central stations themselves do not have sufficient capacity to furnish the current necessary, or that they do not run in the daytime, is a more serious obstacle, as it prevents entirely the selling of articles for which current is desired throughout the day.

COMMERCIAL HEATING.

The development of the various industries has been so rapid that many of them are using the most modern machinery and processes; consequently it would be a rather easy matter to introduce electricity for any purpose for which they are now using other fuels, and which have been substituted successfully in the United States. Among



FIG. 9.—GERMAN CRANES ON WHARF AT PORT OF BUENOS AIRES.



FIG. 10.—TYPICAL HOUSES OF RIO DE JANEIRO.

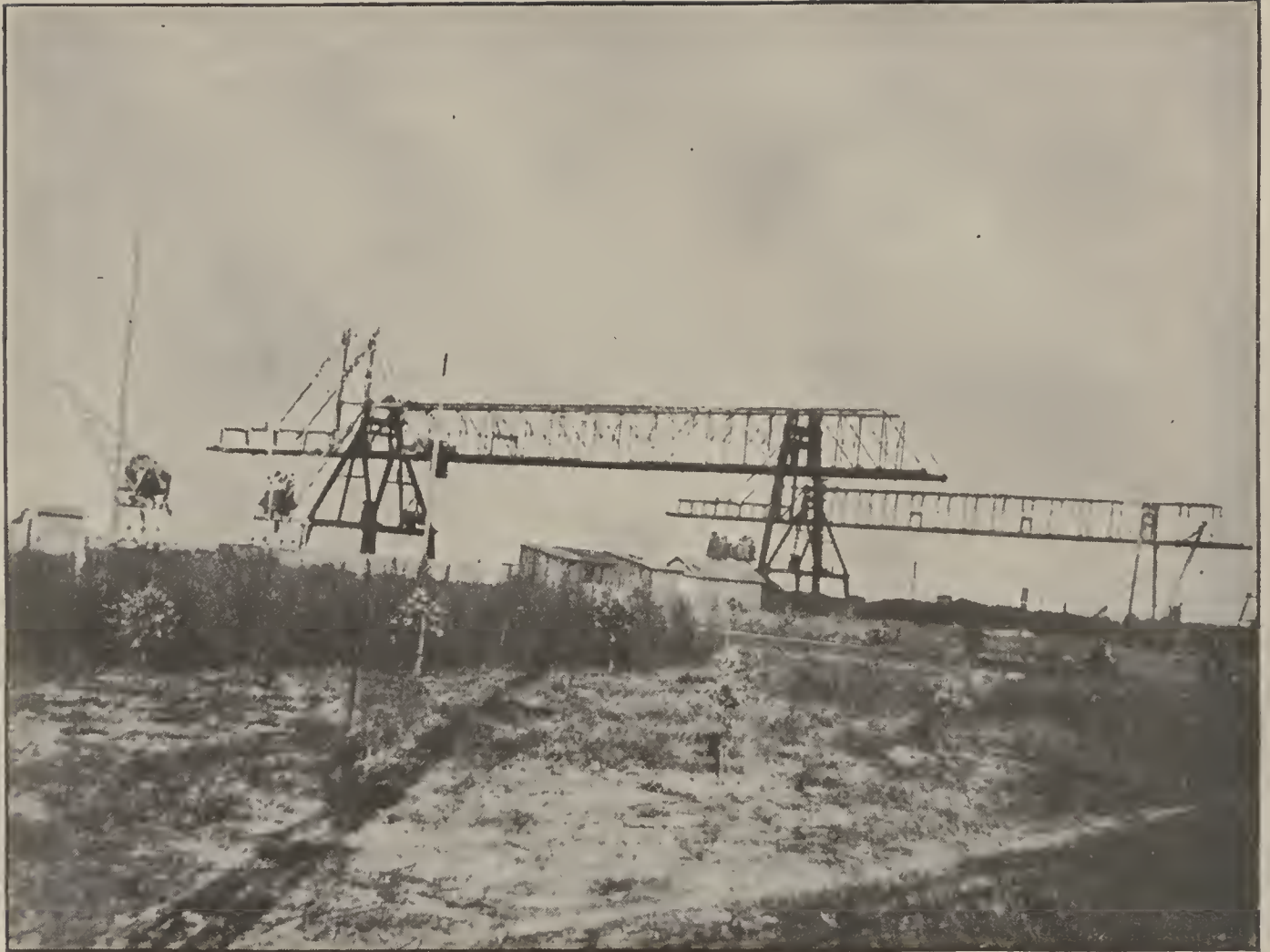


FIG. 11.—ELECTRICALLY OPERATED TRAVELING CRANES FOR LOADING COAL, RIO GRANDE DO SUL, BRAZIL.



FIG. 12.—GERMAN ELECTRIC CRANES ON WHARF AT RIO GRANDE DO SUL, BRAZIL.

other things electricity might be used for heating glue pots, soldering irons, and type-metal melting pots.

For use on a much larger scale the establishment of electric converters for the manufacture of iron and steel has been considered. Various metallurgical experiments with electric furnaces have been carried on at the Ouro Preto School of Mines, but owing to the absence of satisfactory fuel and the high cost of importing it, the prospects of reproducing these experiments on a commercial scale are not very bright.

LITTLE COOKING BY ELECTRICITY.

In those cities possessing gas plants, gas is used extensively for cooking, and this and municipal lighting are practically the only two fields left to it. Stoves, ranges, water heaters, and other equipment are usually handled by the gas companies which also do the installing and repairing. Probably 35,000 stoves are in service, of which about 20,000 are to be found in Rio de Janeiro alone.

Electric ranges have not been pushed either by the central stations or the dealers and such sales as have been made can hardly be credited to the activities of either of these agencies. The smaller stations are interested primarily in their lighting loads, many of them, in fact, not having equipment sufficient to permit the installation of devices which increase their maximum demand as much as electric ranges do. With the installation of new generating equipment contemplated in many towns, this condition will change, as nearly all the central stations have progressive managements which seem to be unanimous in regarding this load as a favorable one for their lines. Continuous propaganda in the shape of advertising and demonstration will be required on the part of the dealer in order to develop the situation successfully.

It should be noted that many circuits are of 220 volts and special care should be given to the construction of heating elements sufficiently rugged to withstand this voltage, as well as the treatment they will receive at the hands of unskilled servants.

Various fuels are available, but gas and wood are consumed in largest amounts. The price of gas varies in different cities, but is usually \$2 to \$3 per thousand cubic feet. Wood, on account of its relative abundance, is fairly reasonable in price.

The tariffs of the various central stations differ materially, but the normal cost of current for lighting purposes may be taken at 15 to 25 cents per kilowatt hour. Power rates are considerably lower than these, but special rates for heating and cooking are available only in a few localities.

POWER.

Until recent years practically all the fuel used was imported coal. The price has increased from approximately \$10 per ton to \$40 or more, and even at that, it is extremely scarce and can be obtained only by a few establishments, such as the large gas plants. Under the protection of these high prices, native coal which has been discovered in considerable quantities in the State of Rio Grande do Sul has been placed on the market and is now selling for \$15 to \$25 per ton for the

best grades and \$3 to \$6 for poor surface coal or lignite. Wood is abundant, but considering its price and deficiency in heating units, can not be considered a cheap fuel. All these circumstances combine to promote the increased use of central-station power.

Comparatively cheap rates are made by the operating companies which are encouraging in various ways the substitution of electricity for other forms of power. There is probably no central station which is not enjoying a considerable motor load. On the circuits in the three cities of Rio de Janeiro, Nictheroy, and Sao Paulo, over 160,000 horsepower is connected, and this figure is growing at a rapid rate.

All the power circuits of importance are 60 cycles, three-phase, and either 220 or 440 volts. Both wound rotor and short-circuited rotor types are permitted. Single-phase motors which might be used on the lighting circuits have not met with general favor except in the sizes of one horsepower or below but are gaining in popularity. Although in certain sections the motors are subject to severe conditions of temperature and humidity, standard insulations as used in motors of high quality appear to give entire satisfaction, so that only occasionally does it become necessary to furnish insulation especially designed to withstand moisture.

USE OF POWER IN MINES.

The interior plateau or elevated section in the central and southern parts of the country abounds in minerals of various kinds. Deposits of coal, manganese, iron, gold, and precious stones have been exploited for many years, and are still being mined, in many instances by the use of modern machinery.

Coal is found principally in Rio Grande do Sul and Santa Catharina, and to a smaller extent in Minas Geraes. A company formed largely by Brazilian capital is working the rich deposit at Sao Jeronymo near Porto Alegre, in the State of Rio Grande do Sul. The daily capacity is 700 tons and this was being extended rapidly in 1918, in order to meet the increased demands for fuel brought about by the prohibition of the exportation of coal from England and the United States. The Cia, Jacuhy, in the same region, has a capacity of 200 tons daily, which it expects to double or treble in the near future. Other companies of momentary importance are also engaged in working an inferior grade of semibituminous coal, but most of their operations are carried on above ground.

The manganese mines are located principally in Minas Geraes, and most of the work of extraction is done by hand labor.

Gold is found in the same State and what is reputed to be the deepest gold mine in the world is located at Villa Nova de Lima, near Bello Horizonte. It is owned by an English corporation, known as the St. John del Rey Gold Mining Co., and in its operations it employs hoists, air compressors, crushers, and other modern machinery, some of which is driven electrically and some by water-wheels. Electric locomotives haul trains in the tunnels and yards, both the storage-battery and trolley type being used. There are several other gold mines, the next two in order of importance being the Ouro Preto Gold Mines of Brazil (Ltd.), with property at Pasagem and the Sao Bento Gold Mining Co., of Sao Bento, both veins owned and operated by British capital.

GREAT DEPOSIT OF IRON ORE.

Iron ore is known to exist in extraordinary quantities. One estimate, said to be conservative, puts the ore in the surface deposits at 2,500,000,000 tons as a minimum figure. A very considerable part of the iron of the world will come from these fields if the plans of English and American companies owing concessions in that region are permitted to mature. The Itabira Iron Mines Co. has been formed with British capital, and the Brazilian Iron & Steel Co. with American capital and both are in possession of large areas of ore-bearing territory. For many years the production of iron ore has been increasing, but no active work is being carried on by these companies at present. The plans for the future, however, are very extensive and include the electrification of the steam railroad which is now being built from Victoria to Itabira, and which is in operation for a distance of 160 kilometers (99 miles) from Victoria. It is not at all improbable that other companies will be formed, and that modern equipment will be installed in many mines which will be made accessible by the completion of this road.

Much has been said about the possibility of smelting this ore locally, but in the opinion of one of the officials of the State of Minas Geraes this is not a feasible proposition, and according to him the manufacture of iron and steel in large quantities will have to be done elsewhere than in Brazil. In one of his annual reports to the State Government, he says:

We have excellent deposits of iron ore, not only with a high percentage of iron but of great purity. The magnetites, the hematites, the itabirites, and the conglomerates are very abundant, but we are not in a condition to be able to exploit the great deposits which we possess; our Governments do not concern themselves seriously as yet with solving the problem of the exportation of this mineral, a problem which is most important, for it would furnish us the necessary element for a rapid economic development.

We must therefore, resign ourselves to see our mineral being manufactured in other countries; it is sheer nonsense for us to wish to establish here a great metallurgical industry; the reduction of the mineral is made only by the aid of coal and this we do not possess, nor can we obtain it on a satisfactory basis—it is the mineral which procures the coal and not the coal which procures the mineral. The converters are always close to the sources of the fuel, as is the case in Pittsburgh, in England, in the north of France, in the vicinity of Liege, in Westphalia, Silesia, etc.

Even in the electric furnaces, reduction of the ore can not be made, except with the use of coal; also electrometallurgy is suited only to a small production of high-grade steel; and as it is to have in the future a free development in Brazil, it would make use of only an insignificant fraction of the available ore which we have.

PRESENT USE OF IRON ORE.

There are at present three converters making cast iron, using wood charcoal as fuel. Sufficient iron has been produced to permit the exportation of a small quantity to Argentina, and in spite of the difficult conditions, the people interested are sufficiently optimistic to believe that much progress can be made in this direction in the future. The St. John del Rey Mining Co. owns valuable deposits of iron ore which it intends to exploit when its gold-mining ceases to produce with profit. Looking ahead to the time when it will turn its attention to the iron fields the company has planted several million eucalyptus trees which it will use as fuel and for general

mining purposes. A solution of the problem, now receiving serious attention, of how to make use of the abundance of continuous water power in connection with these ore deposits, would make of Brazil one of the foremost iron and steel countries of the world.

POWER IN PACKING HOUSES.

The manufacture of dried beef has been carried on in southern Brazil for a long time. The former establishments were primitive and required little or no power. To-day, however, these are giving way to the modern freezing and packing establishments which are in active operation, or will be erected in Rio Grande, Sao Paulo, Rivera, and Rosario. These plants employ power-driven machinery, duplicating similar equipment in use in plants in the United States. In fact, the material is usually purchased through the main offices in the United States, as the Brazilian establishments are subsidiaries of the large American packers. Occasionally material to supply immediate needs is purchased locally, but the bulk of it must conform to the specifications drawn up for the home plants.

POWER IN GENERAL INDUSTRIES.

Every effort has been made during the last four years to encourage the establishment and expansion of local industries, in order to make use of the natural resources of the countries, and furnish employment to as large a part of the population as possible. The two principal centers of industrial development are Rio de Janeiro and Sao Paulo, in both of which places electric power is cheap and abundant, a fundamental condition which is very favorable toward manufacturing development.

The State of Rio de Janeiro, outside of the Federal District, is also important industrially, having at present nearly 1,000 establishments giving employment to over 50,000 workmen. Most of these are located in the city of Nictheroy, which is also plentifully supplied with electric power.

In Sao Paulo, there are approximately 1,200 factories, some of which are of considerable importance. Among these may be mentioned the following: Shoe factories, 43; textile mills, 51; printing offices, 45; machine shops, 52; woodworking establishments, 24; cereal mills, 11; iron and brass foundries, 36; manufactories of metal articles, 12; and sugar refineries, 8.

That electric motors are being employed is shown by the statistics of the central station, which had at the end of 1917 approximately 45,000 horsepower connected to its lines. The increase in connected load is at least 4,000 horsepower annually. In the State of Rio de Janeiro there are over 100,000 horsepower in motors, and the annual increase is approximately the same as in Sao Paulo.

Many other smaller cities are also becoming important industrial centers, and there is hardly a town where a considerable portion of the inhabitants do not find employment in manufacturing enterprises. The most common factories are textile mills, factories making tobacco and dairy and agricultural products, carpenter shops, and coffee-preparing establishments.

ELECTRICITY FOR TEXTILES, COFFEE, TOBACCO.

Perhaps the most prominent manufacturing industry is that producing cotton piece goods and knit goods.

Considerable cotton is raised within the country, and the greater part of it is prepared and woven in local mills. There are also establishments for the fabrication of jute, silk, and wool, but these are of secondary importance. The three leading States in cotton manufacturing are Sao Paulo, Minas Geraes, and Rio de Janeiro, with 51, 53, and 23 mills, respectively. The total number of mills is 240, having 1,005,442 spindles and 56,000 looms. The power installed is estimated at 104,000 horsepower, of which 63,000 is furnished by electric motors, 26,000 by steam engines, and 15,000 by gas engines or water wheels. A relatively small amount of this power is used for individual driving, and this constitutes one of the best opportunities offered for the sale of small motors.

On or near its property practically every coffee plantation has water power, which has been developed to furnish the current for lighting the estate and a small amount of power used to drive the coffee-preparing machine. Many of these machines come already equipped with motors as they are purchased through houses dealing especially in this class of apparatus, but there is also an opportunity for the sale of separate motors. This business can be handled only through local representatives, who will be in contact with the owners of the coffee plantations.

The tobacco industry, while of considerable importance, uses relatively little power. The principal factories are found in Rio Grande and Sao Felix, the latter a short distance from Bahia, which is generally recognized as the center of the cigar and cigarette industry. It would be easy for any of the latter factories to use power if they wish, as the lines of the Cia. Brasileira de Energia Electrica extend there, thus making available as much of the capacity of the Paragassú plant as may be required.

POWER IN SUGAR PLANTS.

As a sugar-producing country Brazil occupies a place of minor importance in comparison with such countries as Cuba and Java. Nevertheless, sugar making is an important and growing industry, and modern machinery is being installed in many of the factories. The crop for the season of 1916-17 yielded little more than 7,000,000 kilos (about 7,000 tons), or considerably less than the maximum crop of 1908-9. On account of the present high price of sugar, greater areas are being cultivated and factories are being remodeled with the expectation of greatly increasing their output. The principal regions where sugar cane can be grown successfully are in the States of Pernambuco, Rio de Janeiro, and Aloguas, although Bahia, Sao Paulo, and Sergipe are also able to raise it on a somewhat smaller scale.

In the States of Sao Paulo, Bahia, Pernambuco, and Rio de Janeiro, some of the factories are already fairly well equipped with machinery, but the efficiency of operation averages low, and there is an immediate necessity for thorough reconstruction. The use of

electric power is attracting widespread attention on account of its success in Cuba and elsewhere, and consequently generating and power apparatus will be in demand in all these sections. At the present time, the average power used in the mills of Sao Paulo is 500 horsepower, but several use considerably more. Owing to the engineering problems involved, it is difficult to generalize on the requirements of the market. This business can be secured only by firms maintaining local engineers competent to cope with the individual problems of each factory. Much German and other European machinery has been used in the past, but recently both old and new firms have had access only to American machinery, and they will not be in a position to revert immediately to the kind of goods they formerly handled. This puts us in a more advantageous position than formerly, and factory representatives or machinery experts could do a great deal toward securing the adoption of American equipment by the new mills as well as by the old ones which will be remodeled.

TRACTION AND STEAM ROAD ELECTRIFICATION.

All the larger towns and cities are provided with street-railway systems, and there is a general tendency toward the establishment of others in towns of a smaller population. The low rate for electricity because of the presence of water power is one of the strongest factors in this progressive movement. The lines in Rio de Janeiro and Sao Paulo are owned by the subsidiary companies of the Brazilian Traction, Light & Power Co. (Ltd.), and combined form the second largest system in South America, the largest being that of the Anglo-Argentine Tramway of Buenos Aires. All the equipment of these lines is of American manufacture, except the three electric locomotives used on the Corcovado Line, which were made by Oerlikon of Switzerland. The cars are all of the open type, some being equipped with four motors, similar to our standard inter-urban type, and the rest having two-motor equipment.

Purchases for this system are made through the Pearson Engineering Corporation, 115 Broadway, New York, upon recommendations of the engineer of the company in Rio de Janeiro.

TRAMWAYS IN NITHEROY, BAHIA, BELLO HORIZONTE.

The Cia. Cantareira and Viacão Fluminense operates the tramway system in Nitheroy, which is the capital of the State of Rio de Janeiro, and is located just across the bay from the city of Rio de Janeiro (which is the Federal District). It has in operation approximately 100 motor cars of the double-truck, two-motor type, with American and German equipment.

The same interests own and operate in Bahia the Cia. Linha Circular de Carris, with 150 motor cars of the single and double-truck type. They also own the elevators and two inclined planes leading from the lower to the upper city. All the electrical equipment is of American manufacture. The municipality owns a short line of electrified street railways and has its own power plant, which is of little importance.

The Cia. de Electricidade e Viacão Urbano operates 20 motor cars with American equipment. This property is owned by the munici-

pality of Bello Horizonte, but is operated by the company, which is in favor of using American machinery exclusively.

CEARÁ, JUIZ DE FORA, PARA, PELOTAS, PORTO ALEGRE.

The Ceará Tramway, Light & Power Co. (Ltd.) is an English company operating some 15 motor cars of the single-truck, two-motor type, equipped with British controllers and motors.

The Cia. Minera de Electricidade has eight motor cars operating on belt lines within the city, and the short suburban line extending into the near-by country. American equipment is used throughout.

The Pará Electric Railway & Lighting Co. (Ltd.) is a British corporation, and its equipment is exclusively British. The management is disposed to purchase only material made in England, either for renewals or additional equipment.

The Rio Grandense Lighting Power Syndicate (Ltd.) is composed partly of local capital and partly of English capital, and operates 10 cars over an extension of track of 14 kilometers (8.7 miles). This it proposes to extend for another 13 kilometers in the near future. The equipment is of English and American manufacture, and the latter would have an equal chance with the former for all new material.

The Cia. de Force e Luz Porto Alegre has 100 motor cars with Dick, Kerr & Co. equipment. Owing to the close relations existing between these two companies, all supplies and new material will be confined to the productions of that factory. There has been some talk of selling this tramway company to an American syndicate, in which case the chance for selling American material would be much better than it is at present.

PERNAMBUCO, RIO GRANDE, SANTOS, SAO PAULO.

The Pernambuco Tramway, Light & Power Co. (Ltd.) is operating some 60 motor cars through the city, and is planning to electrify the steam road which it owns, and which has an extension of track of 10 kilometers (6.2 miles). This may be linked with the present street-railway system, as soon as it is possible to obtain the necessary equipment. It is probable that all material will be purchased in England, although the local management is very favorable toward American goods in general.

The Cie. Francaise du Port de Rio Grande has the concession for port improvements and also for operating the central station and street-railway system in Rio Grande. It has 10 open cars, with two-motor equipment. Its policy is to purchase French machinery and supplies whenever possible.

The City of Santos Improvements Co. received the concession for laying sewers and new water supplies for Santos, and with it the right to furnish light and power and operate the street-railway system. It has 200 motor cars of various types, but nearly all are equipped with British controllers and motors.

Considerable American material has been used in recent years, and while all purchases are made through the London office, the local management has a good deal of influence in determining whether American or British goods shall be used.

The Sao Paulo Tramway Light & Power Co. (Ltd.) is a subsidiary of the Brazilian Traction Light & Power Co., and for the last few years has been extending the tramway system in Sao Paulo. It has now in active operation some 350 motor cars with American electrical equipment, and it is not likely that it will consider any other kind.

In addition to the foregoing, there are several smaller companies, such as the Campo Grande, Sorocaba, and Manaos. In general, the business of both the smaller and the larger companies can be obtained only through local representatives, although much good could perhaps be accomplished by keeping the management of the several companies posted, through correspondence and catalogues, concerning the products or materials on sale. All these companies are well equipped to do their own repair work, including winding coils or completed fields. Many of them are also quite expert in making mechanical repairs and in constructing much of the framework or even complete car bodies.

INTEREST IN STEAM-ROAD ELECTRIFICATION.

For some little time there has been a good deal of interest in the electrifying of the present steam roads, and some progress will probably be made in this direction in the next few years. The Cia. Paulista, operating in the State of Sao Paulo, has already completed its preliminary study and drawn up complete plans and specifications for the electrification of a large part of its main lines. All further work is being held up pending a return to normal conditions in the manufacturing centers of Europe and the United States, but the company is expected to call soon for particulars on the necessary generating and power machines. This is one of the most prosperous railways in Brazil, and there would seem to be no obstacle in the way of the fulfillment of its plans. Other roads, knowing of the intention of the Paulista Co., are waiting for it to take the initiative, and the successful completion of the project would probably result in similar activity on their part.

The Sao Paulo Railway Co., which operates between Sao Paulo and Santos, is another very wealthy road, and is contemplating the electrification of its line, particularly that section which includes the present cableway near Santos. For both of these projects ample power would be available, either from the plant of the Cia. Docas de Santos or the Sao Paulo Electric Co., or from new plants which the companies would install independently in the vicinity of the lines.

The Central Railroad of Brazil (Estrada de Ferro Central do Brazil) is owned by the Brazilian Government and extends from Rio de Janeiro to surrounding States. Studies have been made for the electrification of its suburban lines and of the entire main line extending from Rio de Janeiro to Barra do Pirahy. This latter section is particularly difficult for steam operation, as it involves a winding ascent of heavy grades and the expenditure of a great amount of fuel. With imported coal at \$30 a ton or more the saving by electrical operation would be very great, and even at the pre-war price of \$8 it would be more profitable to operate with hydroelectric power furnished by one of the large operating companies in that district.

The railway now operating from the city of Victoria, and known as the Victoria-to-Minas Railway, will some day be extended to the Itabira iron-ore district in the State of Minas Geraes. Considerable progress has already been made in the plans for the electrification of the line, the power to be generated at three falls on the Pico Doce, with a total capacity of 50,000 horsepower. It is understood that this contract has already been promised to an English firm of engineers and manufacturers.

TELEPHONES AND TELEGRAPHS.

TELEGRAPH AND CABLE LINES.

The telegraph lines are under the control of the Government and are managed by the department known as Direccão Geral dos Telegraphos. There are approximately 42,000 kilometers (26,000 miles) of lines with 75,000 kilometers (46,500 miles) of wire reaching from the capital to more than 800 stations located throughout the country. In recent years a special commission has been at work locating strategic lines to serve the great interior district of the upper Amazon, which is practically an unknown and unexplored wilderness, having as its only means of communication with Rio de Janeiro the boats which ply the Amazon River and its tributaries.

A private cable has been laid in the bed of the river, connecting Para with Manaus, as experiments with wireless equipment for this service have so far proved rather unsuccessful.

All supplies for the department of telegraphs have been purchased previously from European manufacturers, as they have always made a special practice of facilitating the efforts of the Government in such matters as terms of payment, character of material required, and elimination of middlemen. Detailed information regarding goods which this department requires, together with the estimated average annual purchases, are on file at the New York office of the Bureau of Foreign and Domestic Commerce, Room 734, Customhouse.

WIRELESS TELEGRAPH.

Some few years ago the Government entered into a contract with the Marconi interests, under the terms of which the latter were to install and maintain whatever wireless stations and equipment the Government might require from time to time. Some 20 medium-power land stations have been erected, and all boats in the Navy and the merchant marine are equipped with stations of power sufficient to keep them always in communication with some station on the coast. Under normal conditions of navigation aspirants for the position of wireless operator are trained by the Government, and the use of private sets is so restricted that there is practically no opportunity for the sale of amateur sets.

In 1918 certain Government officials were active in opposing the renewal of the above contract, in order that the Government itself might take over complete control and operation of all except the high-power international stations.

TELEPHONES.

The most modern and complete telephone equipment in South America is that owned and operated by the Brazilian Traction Light

& Power Co. Its two main exchanges are located in Rio de Janeiro and Sao Paulo, but its lines radiate over a large part of the States of Sao Paulo and Rio de Janeiro, and, to a smaller extent, Minas Geraes. Double toll lines have been installed recently between Sao Paulo and Rio de Janeiro and extensions are being made rapidly to take in or make connections with independent exchanges located in various nearby towns. All the material used by this company is American made, and the installations are under the control of American engineers. There are at present, approximately 40,000 instruments in active service, which is over 10,000 more than in 1914. This rapid expansion is due to the natural growth within the territory and the absorption of other companies, and it is probable that it will continue at even a greater rate for the next few years.

The smaller exchanges throughout the country are equipped in general with European local-battery magneto-ringing instruments, with grounded return circuits. The system of the Brazilian Traction, Light & Power Co. is of metallic return, and, wherever possible, lines are being placed in underground conduits, since the company follows everywhere the best American practices.

All towns of importance have telephone systems, but there is little to be said regarding them, except that all companies show a general tendency to adopt more modern equipment. Wherever American switchboards or instruments have been used they have given entire satisfaction, and by properly cultivating this market, American manufacturers can secure practically a monopoly of the business of the larger exchanges. It would be very desirable to have a special engineer located in Brazil to assist the company to solve its problems and recommend the proper type of apparatus to install, and this would probably be profitable in due course.

There is a field for the investment of capital either in the establishment of new companies or in the amalgamation of those already established, as is indicated by the experience of the Cia. Telefonica Rio Grandense, with headquarters in Porto Alegre, Rio Grande do Sul. This company has lines connecting some 50 exchanges covering practically the entire State of Rio Grande do Sul. It is very progressive, and is largely owned by Uruguayan capital. In Porto Alegre, it has a small central-battery equipment, but the majority of instruments are of the local-battery magneto-ringing type. At present it has more than 6,000 subscribers, and is planning considerable extensions for the near future. American equipment has been used to a small extent, and efforts should be made to see that it is more widely adopted, as the company is apparently very well satisfied with the goods it has used thus far.

A list of the more important telephone companies is given on page 133.

MARKET FOR SPECIFIC ARTICLES.

ARC-LAMP CARBONS.

Arc lamps for public illumination and for private use are confined very largely to Rio de Janeiro, Sao Paulo, and Santos. The total number of arc lamps in active operation does not exceed 12,000 and the consumption of carbons may be estimated. Practically all arc lamps are of American manufacture and the carbons used give

satisfaction. The purchasers of this material are the central stations operating in the respective cities.

BATTERIES, DRY AND STORAGE.

The demand for dry batteries is rather extensive, as they are used in large numbers for doorbells, automobile ignition, and telephones. Several kinds made in the United States have met with a reasonable degree of success and are looked upon as standard. However a company has been formed with fairly strong local backing to manufacture and push the sale of dry batteries, and it hopes to secure a large part of the business now enjoyed by foreign firms. Tests indicate that when fresh, at least, these batteries compare favorably with the best American cells, and can be sold considerably cheaper. One distinct advantage which it possesses is that, as it is made in Rio de Janeiro, dealers can be assured of a continuous supply of fresh batteries, whereas the imported goods are received with such irregularity that many of them become useless before they are sold. This situation would be helped by using extra care in the selection of batteries for export, and by arranging for shipment in small quantities but at frequent intervals. Cutting down the loss would mean a reduction in the retail price, which is highly desirable, as the local batteries have a strong appeal to the purchasing public because of their being a national product.

If American manufacturers have difficulty in securing a volume of business they expect, it may be worth while to consider the erection of a small plant in Rio de Janeiro to manufacture the batteries. The possibilities in such a project will become more and more apparent with the increased availability of labor and cheap power, and the favorable concessions which are being made to encourage the establishment of local industries.

The field for storage batteries is created by the several tramway systems and the steam railroads which use electrically lighted trains. For the first, the total capacity in use at present probably does not exceed 20,000 ampere-hours; of this amount, one-half is in Rio de Janeiro. Both European and American types of train-lighting equipment are popular, and the latter certainly has at least an equal chance for the business. Most of the sets now in use came already attached to the cars. The representative of a car-manufacturing corporation might easily act as agent for the car-lighting system, including the storage batteries.

American automobiles have been gaining in popularity very rapidly, and as each one is supplied with batteries for starting and lighting it will soon be imperative to establish branches or service stations for the care and sale of suitable equipment. This applies to several of the larger cities, but even in the smaller towns the number of automobiles in use is increasing all the time, and the demand for new batteries or repair parts is expanding to a corresponding degree.

BELLS AND ANNUNCIATORS.

Doorbells are in common use in all houses and there is no one kind which is more popular than another, although the metal box is used to a greater extent than the wooden box. It has been said that the supplying of various finishes to match interior decorations might

result in increased sales, but it would hardly seem justifiable to go to any great expense in making preparations, as the total sales that might be made are rather limited.

Push buttons, both of the simple wooden kind and the more elaborate designs in bronze, have a ready sale for the better class of residences. The more ornate push buttons are very much liked for interior use. Instead of the customary form of floor or table button, a so-called pear button suspended from the ceiling by a flexible cord, is commonly used. This is made of wood or porcelain and sometimes is very fancy.

The demand for annunciators is very small, being confined largely to hotels and pensions, and large sizes are required, having a capacity of 20 numbers or more. More could be used if the wiring contractors were educated up to the value of demonstrating their usefulness, but this is a campaign which can be undertaken only by the dealers on the ground.

CONDUIT AND ACCESSORIES.

maintain their own inspection department, and encouraged the use of high-grade material, there has been quite a market for flexible-steel conduit of the better grade. The practice followed in wiring larger

Since the central stations in Sao Paulo and Rio de Janeiro used to buildings is to lay this conduit directly in the concrete floor and walls. This is particularly an article of American manufacture, and not only have we enjoyed the bulk of this business, but we shall continue to do so in the future. The lighter such conduit is in weight, the less it will cost to import, and consequently the greater will be its sale in comparison with the competitive brands of much greater weight.

Rigid iron conduit is also used in quantities, but a make about one-third less than our standard would be amply sufficient for the needs and would sell in greater amounts.

The cheapest grades of conduit such as the Bergmann type are not allowed on some circuits, but are used in many of the small installations in the interior. The general demand is for rather higher-grade material and this certainly should be encouraged by our manufacturers, since to cater to those asking for very inferior material not only cheapens the market, but encourages competition of a nature which it is difficult to meet.

In all the larger cities, there is an increasing extension of the underground conduit systems. Much of the cable is laid directly in the ground, or in brick-lined ditches, but fiber conduit has been used very successfully, and with some effort on the part of selling agents it should be possible to extend the sale of this material more widely.

ELECTRIC AUTOMOBILES.

There are in active operation one or two electrical passenger cars, but there does not seem to be any interest in extending their use, either on the part of the central stations or the automobile dealers. In the cities of Santos, Sao Paulo, and Rio de Janeiro, and the upper city of Bahia, a majority of the streets are sufficiently well paved to make the use of automobiles a pleasure, but in most of the

other cities the paving is confined to several of the main streets only. It is probable, however, that the only place where pleasure vehicles would be reasonably sure of any sale would be in the city of Rio de Janeiro. There appeared recently five large automobiles for carrying passengers, which had been constructed in the United States and were equipped with American motors, controllers, and batteries. If the venture is obviously successful it may have a favorable effect on the demand for passenger electric cars, otherwise little encouragement can be extended to manufacturers of these cars so far as Brazil is concerned.

FANS.

Fans of all kinds have a very ready sale, since the climate favors their use throughout a large part of the country, and for a considerable part of the year. The 12-inch bracket fan, suitable for desk or wall operation, is most popular, and the oscillating type is likely to displace the fixed type completely. The introduction of a smaller fan, that is, one having a diameter of approximately 6 inches, would meet with a ready response, especially if it could be sold at a relatively low price; such a fan would be desirable especially for individual office and home use.

Fans with four or six blades suspended from the ceiling or attached to vertical columns are used in hotel dining rooms and restaurants in many cities, and will undoubtedly remain popular for such uses. Competition from European makes has been severe in recent years, principally because ours are always higher in price.

Exhaust ventilators are used very seldom, although they have been installed to some extent in hotels and restaurants. Apparently this field has been overlooked.

FARM-LIGHTING SETS.

In the southern part of Brazil, where there are a number of ranches located long distances from the central stations, there is a small market for self-contained lighting sets consisting of low-voltage generators driven by kerosene or gasoline engines. Probably the 50-light and 100-light sets are the best sellers. It is hard to determine whether these sets should be accompanied by storage batteries or not, as the breakage is likely to be very high unless they are packed with unusual care and they would be operated by unskilled labor, with no mechanical training and little mechanical instinct. With the battery eliminated, of course the argument in favor of such apparatus loses much of its force, since it will no longer be possible to have light continuously unless the machine is running, nor will the engine be self-starting. It is believed, however, that these advantages can be dispensed with, since under any conditions electric lights are so superior to kerosene or acetylene gas, which are the forms now in common use; and if the batteries are not taken care of properly they are soon out of commission anyway. Engines for this use should be capable of operating on alcohol and especially kerosene, as the price of gasoline is almost prohibitive. Since this method of farm lighting is a very new development, little information regarding its possibilities is available, but one or two agencies for American apparatus

have been established and the results so far obtained indicate that they will be successful.

FIXTURES.

The general practice with regard to fixtures follows closely upon that of Argentina and other countries, the most common system being the drop-light, consisting of two lamps on the end of a flexible cord, suspended in the center of the room. In the better class homes, chandeliers and fixtures of various types are becoming popular, and the newer forms of indirect and semiindirect units are being introduced in the larger cities. Side-wall fixtures are seldom used, nor is it permissible to use chandeliers for both gas and electricity. In some cases, however, a special kind of insulated attaching arm can be used, provided extra care is taken in keeping the wires from coming in contact with the fixtures. In many instances, the older types of candle or gas burning chandeliers have been remodeled, or gas has been abandoned for illuminating purposes, and the necessity of purchasing new fixtures has thus been avoided. A great many chandeliers were adorned with crystal and glass pendants and new ones of this character are in demand, especially very elaborate types suitable for very wealthy homes.

Drop-lights and table lamps with fancy standards and shades are growing in popularity, and almost any of the more artistic designs are suitable for this trade. Much electrical material is made locally either from original designs or from imported material, but local makers are unable to turn out the finer class of goods, in which the biggest field for our future business seems to lie.

Glass shades and reflectors have been used in large numbers as a result of an active selling campaign on the part of manufacturers. A continuation of such policy would be successful in building up trade in the metal reflectors of the so-called scientific designs.

Porcelain shades are not particularly popular, and those which are intended for this market should be much lighter in weight than our standard shades, in order to reduce the cost of freight and duty. One dealer, finding himself with a larger quantity of this material than he could dispose of, engaged several students in the art school to decorate the shades with various pictures, such as landscapes and conventional designs. By this means he was able to charge enough to more than cover the additional cost, and sold them as ornamental rather than merely useful shades. On account of their heavier weight he was unable to compete with the cheaper European designs which are still to be had.

FLASH LIGHTS.

There is no apparent reason why portable lamps should not find in the larger cities a market equally as large, in proportion to population, as the market in the United States. To build up such a business, however, it is necessary to do the same amount of advertising and put out the same displays and propaganda as in this country.

Extra precautions should be taken in the selection of batteries, as the ocean voyage is very trying upon them, and the climatic conditions are not of the best for conserving their strength. Frequently a large number of batteries are useless on arrival, and this so in-

creases the cost of the good ones that very few people care to, or indeed can afford to, purchase them. A satisfactory solution of this difficulty must be found, perhaps by local manufacture or by making a special type for foreign trade, if this trade is to be increased. Frequent shipments of small lots will help.

Advertising window displays and practical demonstrations are essential factors in making known the qualities of flash lights. Too often the lamps and batteries are allowed to become shopworn and dirty, thus presenting a very uninviting appearance, which must detract from their sales. It is a difficult part of the manufacturers' work to convince the dealer who handles his products how to display and maintain them in a salable condition.

FUSES.

Standard American plugs and cartridge fuses are the ones most commonly used and there are very few of any other kind, the standard product of any of our factories being entirely satisfactory. The practice followed in using fuses on the various branch circuits is very similar to ours, consequently, the demand in many cities is comparable to the demand at home for the same number of central-station customers.

HOUSEHOLD AND OFFICE DEVICES.

Small motor-driven apparatus is practically unknown, and efforts to introduce it have resulted in a practical failure; the conservatism of the people does not permit them to adopt such devices very readily, and their mode of living does not require the use of many articles which have become almost indispensable to us. It is only by persistent effort that a new condition can be brought about whereby such material can be said to be really in demand.

The smaller heating devices such as flatirons, toasters, and grills have been introduced and pushed long enough to have created a fair market in the larger cities. This is especially true where the central station has taken a hand in demonstrating them, as in Para. The Para Electric Co. maintains a salesroom where all these articles are on display and may be tested—a mode of selling that appeals very much to the people in general. Much more could be done if the retail dealers and their clerks were more alert in the sales methods. Customers frequently enter a store to investigate the merits of some device in which they are interested, and while it is always shown to them, it is done in such an apathetic manner that the effect is more often to kill than to make the sale unless the prospective customer already has a firm intention of buying the article. This is a difficulty which can hardly be remedied by correspondence.

INDUSTRIAL CONTROL MATERIAL.

Industrial development has greatly increased with the use of electric motors and their proper controlling apparatus, but in practically every instance the two are purchased together, so that there is little opportunity for building up a business in controllers alone. No "safety-first" rules have been adopted, nor are any contemplated so far as is known. Occasionally, individual manufacturers would

purchase such articles if their advantages were demonstrated, but there would have to be some popular demand or some Government regulation specifying the use of such devices before the sale would be appreciable.

INSULATORS.

For inside wiring, the standard form of cleat is used very frequently instead of the European form. This applies particularly to the installations made by branches or representatives of American factories. In the smaller localities, these are replaced by the European knobs, which are much smaller than ours, both in diameter and height. For telegraph and telephone work, glass insulators are used to a small extent, but the porcelain insulators are generally more prominent.

Dimension drawings of the insulators which have been adopted as standard by the department of posts and telegraphs of the Brazilian Government have been obtained and are on exhibition at the New York office of the Bureau of Foreign and Domestic Commerce, where they may be inspected by those interested. From what has been said about transmission lines (see p. 108), it will be seen that there are in use already a large number of insulators for 24,000, 44,000, and even 88,000 volts.

There are also in the city of Rio de Janeiro, approximately 700 kilometers (43.5 miles) of overhead circuits for 6,000 volts. These are all supported on pin-type porcelain insulators, which are also used throughout the country for circuits of 24,000 and 44,000 volts. Both European and American types have been used.

As everything points to the continued extension of transmission lines, particularly in the States of Bahia, Rio de Janeiro, Minas Geraes, Sao Paulo, and Parana, it is evident that there will be a continuous demand for suitable insulators. American types are very much in favor and if presented properly should be successful in satisfying a large part of the demand.

LINE MATERIALS.

The extension of transmission lines in all directions is making necessary the use of overhead material of all sorts. The voltage of the longest transmission is 44,000, while the highest voltage is 88,000. The greatest amount of line material is used between the two large companies, the Brazilian Traction, Light & Power Co. (Ltd), controlling the central stations in Sao Paulo and Rio, and the Cia. Brasileira de Energia Electrica, both of which use American material almost exclusively.

Line material for low-tension circuits for power and light distribution is being continuously used and undoubtedly will be in greater demand in the near future, since many of the smaller stations are planning to increase the area covered by their lines as soon as it is possible to obtain the necessary wire and other materials. Development has been retarded in practically every central station by the high prices, but to-day this has come to be rather a secondary consideration, and the demands of new consumers must be taken care of.

The tramways follow American or English practices in the matter of overhead construction, and our standard material can be used for

replacements. When the projected electrification of steam railroads is accomplished, as noted above, there will be a corresponding demand for line material of highest grade.

MEDICAL APPARATUS.

Small appliances such as vibrators and violet-ray producers have been meeting with some success with the general public. The strictly medical apparatus, that is, wall cabinets furnishing galvanic and sinusoidal current for direct bodily application, cauterizing, etc., have had a very limited sale. Apparently this is due more to a lack of propaganda by the dealers than anything else, as the profession in general is reputed to be progressive in its methods and equipment. No dental office is considered up to date unless equipped with the latest American apparatus.

All hospitals have X-ray machines, most of them being of European manufacture. More will undoubtedly be purchased from time to time, and there is a small continuous sale for renewal tubes.

METERS.

None of the important central stations will tolerate flat-rate service, and as a result there is a constant market for watt-hour meters. The sizes most in demand include those of a capacity of 2 to 10 amperes. For ordinary household circuits practically all are for single phase, 120 or 220 volts, 60 cycles, as all the larger stations furnish current with these characteristics. There is a smaller demand for direct-current meters, for three-phase power meters, and for 50-cycle meters in the circuits of lighting companies. In Rio de Janeiro and Sao Paulo there are over 90,000 meters, and the annual requirements are normally about 10 per cent of this number.

In the smaller plants European meters have been largely used, especially in those equipped with European machinery. American makes, however, are in general giving entire satisfaction, and if modified to meet some of the local requirements will be able to continue to occupy the favorable position they are now holding.

The special features desired vary among the different users, and consist in general of glass covers and iron-clad conduit terminals for entrance wires, cyclometer or direct-reading dials, and such mechanical construction as will exclude as far as possible tropical bugs and insects.

TOYS.

Electrical toys have so far found no sale whatever, and the possible field is confined to the small foreign colonies in or near the larger cities. Perhaps this condition will change, but the general sentiment and temperament of the people apparently do not incline them toward the use of such devices.

TRANSFORMERS.

On account of the great amount of alternating current used the market for transformers is fairly large. The practice in Rio de

Janeiro and Sao Paulo is to install large units in underground switching stations feeding the distribution circuits. In the smaller places the transformers are installed above ground and are also of fairly large capacity. The use of pole-top transformers is confined to a few localities following American practices. There is little or no regular demand for the very small sizes for individual installations.

The transformers used in Rio de Janeiro for secondary circuits are wound for 6,000 volts primary, and 216.5–125 volts secondary. The primary has a delta winding and the secondary a star winding, with grounded neutral. The distribution is made on a four-wire, three-phase basis at the above voltages.

WIRE AND CABLE.

Wire and cable form one of the largest items in electrical importations. Formerly, only the best grades of American wire were used, but of late years European competition has tended to cheapen the market, with the result that the largest demand is for European types of insulation. Several American manufacturers have produced this quality of wire and have been successful in obtaining a large part of the business. The kinds most used are those familiarly known as the V. I. R. (vulcanized india rubber), other kinds produced by the Cable Makers' Association of England, and the inferior grades usually supplied by Germany.

Bare transmission wire is used only on the long-distance lines, as the municipal authorities in practically every locality insist that insulated wire be used within the city limits.

Aluminum wire has been used with considerable success in the city of Santos, and although various other companies have expressed an interest in it none has as yet tried it out.

Lead-covered wire is used in moderate quantities, but the lead sheathing should be as much thinner than our standard as possible, in order to lower the cost of the importations. The sizes most used consist of two conductors, No. 14 or No. 12 Brown & Sharpe gauge wire.

Underground cables are used in the installations in the larger cities and for this work both American and English cables have been employed. That the latter has some preference can be seen from the statistics, which show that the only line in which English manufacturers have the advantage over all other countries is electrical cables. Of a total of \$824,986 worth of cable imported in 1913, \$409,051 worth, or nearly 50 per cent, was supplied by England. Germany and the United States each furnished about an equal amount, which together was less than the amount supplied by England.

In Rio de Janeiro the principal types of cable installed are 1,000,000 circular mil, paper insulated and lead covered, to be laid directly in the ground; and paper insulated but unarmored for insulating in fiber ducts. For the low-tension feeder circuits both armored and unarmored cables for three-phase, four-wire operation are installed. For the aerial circuits, weatherproof, insulated wire of sizes from No. 6 Brown & Sharpe gauge to 500,000 circular mil are used.

Considerable amounts of round, single, and double cotton-covered magnet wire are used by the tramway companies for winding arma-

ture and field coils. All these companies prefer to make their own repairs rather than buy factory-made coils, with the result that there is demand for this kind of wire in various sizes, depending upon the kinds of motors in use.

A large amount of flexible cord is used, since much of the house wiring, especially in the interior, is for drop-lights.

Competition has been entirely from European factories in the past, but the Japanese industry has taken advantage of the unusual conditions now prevailing and is offering wire and cable at prices rather lower than those asked by American manufacturers. As yet very little of this material has actually been purchased, but apparently the representatives of the Japanese industry are determined to obtain a large share of this trade if they can.

As in other lines, price is the principal consideration, and we must be prepared to meet the prices quoted by others, either on our own standard type of wire or on special types manufactured for foreign trade, if we are to maintain the lead which is now ours.

APPENDIX.

TELEPHONE COMPANIES IN URUGUAY.

Name.	Subscribers.	Address.
Cia. Telefónica de Montevideo.....	8,500	Montevideo.
Sociedad Cooperativa Telefónica Nacional.....	3,700	Do.
Empresa Telefónica La Union.....	582	Durazno.
Empresa Telefónica La Union.....	370	Mercedes.
Empresa Telefónica Sarandi del Yi.....	80	Sarandi del Yi (Durazno).
Telefono Helvético.....	60	Neuva Helvecia (Colonia).
Telefonos de Colonia.....	150	Colonia.
Empresa Telefónica Progreso.....	470	Minas.
Empresa Telefónica La Activa.....	350	Trinidad (Flores).
Empresa Telefónica La Economica.....	445	San Fructuoso (Tacuarembó).
Empresa Telefónica La Nacional.....	502	Paysandu.
Empresa Telefónica La Uruguaya.....	220	Melo (C. Largo).
Empresa Telefónica Stratta.....	182	Artigas.
Empresa Telefónica La Rural.....	38	Conchillas (Colonia).
Empresa Telefónica La Economica.....	250	Rocha.
Empresa Telefónica La Oriental.....	185	Dolores (Soriano).
Empresa Telefónica Rio Negro.....	110	Paso de los Toros (St. Isabel).
Empresa Telefónica Rio de la Plata.....	190	Maldonado.
Empresa Telefónica La Carolina.....	142	San Carlos.
Empresa Telefónica Tomas Gomensoro.....	25	Artigas.
Empresa Telefónica La Berliner.....	130	Treinta y Tres.
Empresa Telefónica La Uruguaya.....	210	Carmelo (Colonia).
Empresa Telefónica La Internacional.....	620	Rivera.
Empresa Telefónica La Oriental.....	300	Trinidad (Flores).
Empresa Telefónica Salteño.....	340	Salto.
Empresa Telefónica La Sanducera.....	(a)	Paysandu.

a No data.

CENTRAL STATIONS IN URUGUAY.

Location and name of plant.	Motive power.	Capacity.	Characteristics of circuits.	Make of machinery.
		<i>Kilowatts.</i>		
Canelones: Usinas Eléctricas del Estado.....	Petroleum.....	55	220 D. C.	American.
Carmelo: Empresa Eléctrica de Carmela.....	do.....	118	220 D. C.	
Colonia: Usinas Eléctricas del Estado.....	Steam.....	495	a220 A. C.	German.
Durazno: Empresa Eléctrica de Durazno.....	Producer gas.....	163	220 D. C.	Do.
Florida: Empresa Eléctrica de Florida.....	Petroleum and producer gas.	191	150 D. C.	
Fray Bentos: Municipalidad de Fray Bentos.	Steam.....	80	110 D. C.	
La Paz: Usinas Eléctricas del Estado.....	Substation fed from Montevideo.	.....	a220 A. C.	
Las Piedras: Usinas Eléctricas del Estado.....	do.....	.....	a220 A. C.	
Maldonado: Usinas Eléctricas del Estado.....	Petroleum.....	160	a220 A. C.	Swiss.
Melo: Empresa Eléctrica de Melo.....	Steam.....	190	220 D. C.	
Mercedes: Empresa Eléctrica de Mercedes.....	.....	.....	b135 A. C.	
Minas: Empresa Eléctrica de Minas.....	.....	.....	b135 A. C.	
Paysandú: Empresa Eléctrica de Paysandú.....	.....	.....	220 D. C.	
Punta del Este: Usinas Eléctricas del Estado.	Substation fed from Maldonado.	.....	a220 A. C.	
Rivera: Empresa Eléctrica de Rivera.....	.....	.....	220 D. C.	
Rocha: Empresa Eléctrica de Rocha.....	.....	.....	220 D. C.	
Salto: Empresa Eléctrica de Salto.....	.....	.....	220 D. C.	
San Carlos: Usinas del Estado.....	Substation fed from Maldonado.	.....	a220 A. C.	
San José: Empresa Eléctrica de San José.....	.....	.....	220 D. C.	
Tacuarembó: Usinas del Estado.....	Steam.....	150	220 D. C.	
Trinidad: Empresa Eléctrica de Trinidad.....	Petroleum.....	219	220 D. C.	German.
Montevideo: Usinas Eléctricas del Estado.....	Steam.....	c 17,000	a220 A. C.	

a Three-phase, 50 cycles.

b Single-phase, 50 cycles.

c To be increased to 27,000 with the installation of the new turbogenerator unit bought in the United States (General Electric Co.) in 1918.

The Administration General of the Usinas Eléctricas del Estado is ready to undertake the establishment of plants in the following places as soon as the conditions are more favorable: Dolores, Jose Batille y Ordonez, Pando, Rosario, San Eugenio, Santa Lucia, Sarandi del Yi, and Treinta y Tres.

TELEPHONE COMPANIES IN BRAZIL.

Rio de Janeiro & Sao Paulo Telephone Co.

Brazilianische Electricitäts-Gesellschaft, operating in city and Federal District of Rio de Janeiro.

Cia. de Telephones Internestadoaes, operating in the State of Minas Geraes.

The Interurban Telephone Co. of Brazil, operating in the State of Rio de Janeiro.

Cia. Telephonica do Estado de Sao Paulo, operating in the cities of Sao Paulo, Santos, Campinas, etc., in the State of Sao Paulo.

Cia. Rede Telephonica Bragantina, operating in the State of Sao Paulo.

Cia. Telephonica Rio Grandense, Porto Alegre, Rio Grande do Sul.

Telephone Co. of Pernambuco (Ltd.), Recife, Pernambuco.

Empresa Telephonica do Bahia, Sao Salvador, Bahia.

Empresa Telephonica do Ceara, Fortaleza, Ceara.

Para Public Works Co. (Ltd.), Belem, Para.

Cia. Telephonica do Maranhao, S. Luiz, Maranhao.

Cia. Mineira de Electricidade, Juiz de Fora, Minas Geraes.

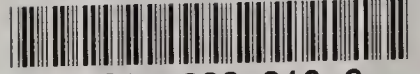
Cia. de Electricidade y Viacão Urbano, Bello Horizonte, Minas Geraes.

LIST OF DEALERS.

Lists of importers and dealers in electrical machinery and supplies in the east-coast countries of South America may be obtained from the Bureau of Foreign and Domestic Commerce or its branch and cooperative offices. When making request for these lists, refer to the following file numbers: Argentina, file 40307; Uruguay, file 40308; Brazil, file 40309.



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